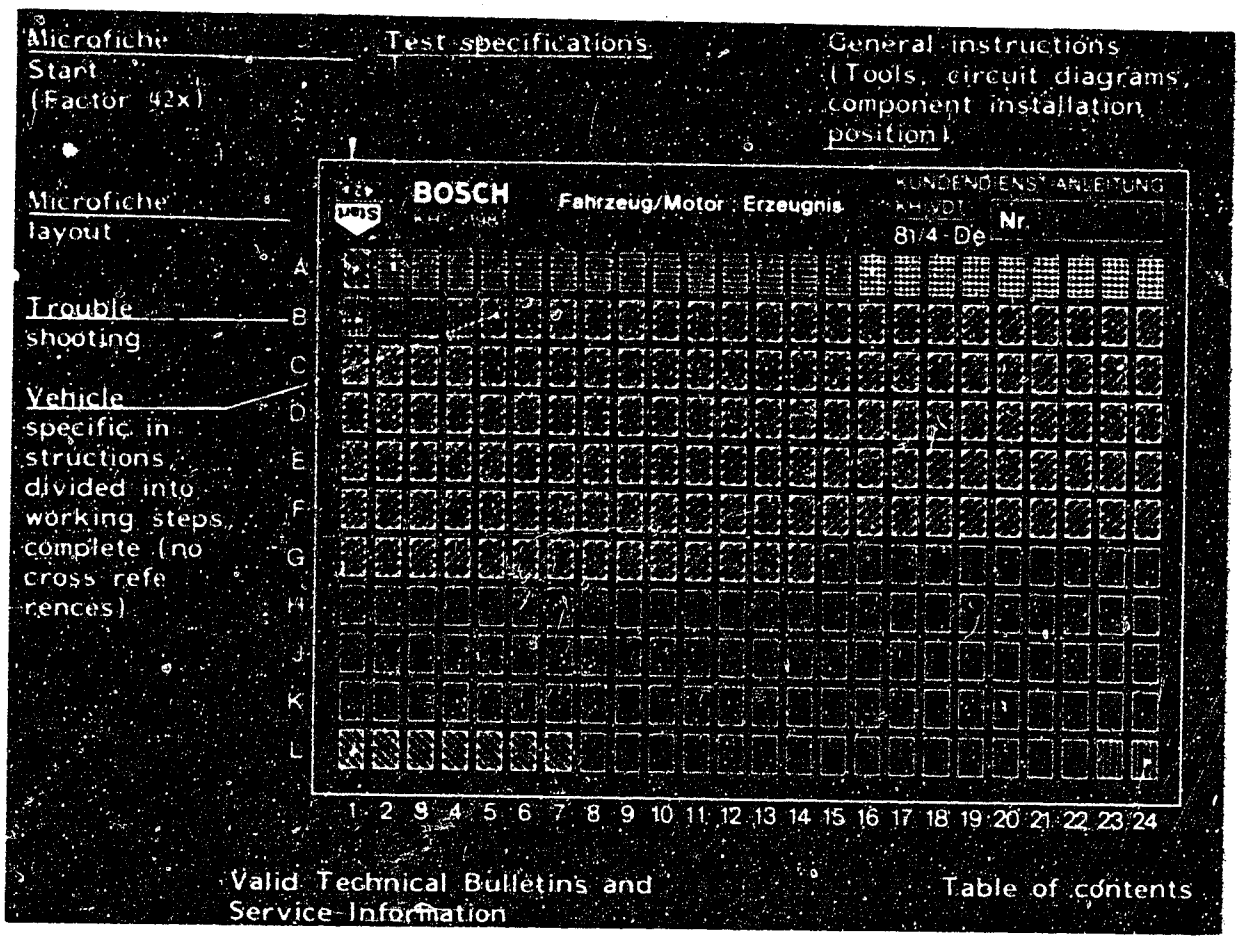
Microfiche layout



1. Read from left to right

2. Title of microfiche (appears on each coordinate)

E16	Product/assembly/test step Vehicle/engine	

Coordinate

3. Limits of section

Beginning	Mid-section	End	One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

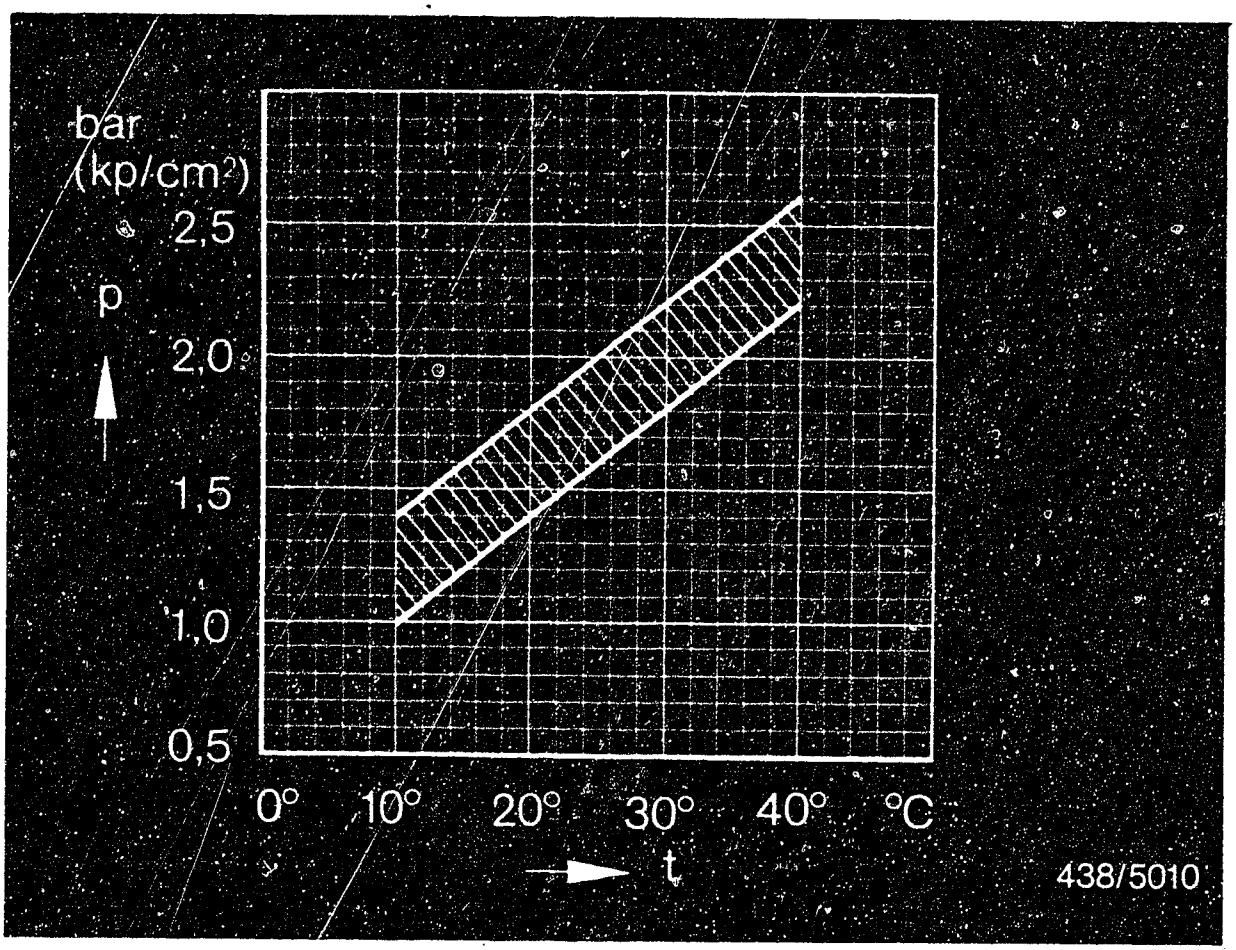
C6

1. Test specifications

1.1 Electric fuel pump

B 20

Test step	Test specifications
Fuel delivery:	min. 960 cm^3/30 s



p = Control pressure (gauge pressure)
t = Ambient temperature

C 12

1.2 Control pressure "cold"

Part No. of warm-up regulator: 0 438 140 082

Test with engine stopped,
i.e. without intake-manifold pressure.

Test step	Test specifications*
1.3 Control pressure "warm" **C12**	
Part No. of warm-up regulator 0 438 140 082	
• Testing without charge-air pressure:	3.4...3.8 bar (3.5...3.9 kgf/cm²)
• Testing with simulated charge-air pressure (gauge pressure): 450...550 mbar (340...410 mm Hg):	2.6...3.0 bar (2.7...3.1 kgf/cm²)
• Leak test on full-load diaphragm	
Test pressure:	600 mbar (450 mm Hg)
Pressure drop:	66 mbar (50 mm Hg)
1.4 Primary pressure **D10**	
Checking value:	5.1...5.8 bar (5.2...5.9 kgf/cm²)
Setting value:	5.3...5.5 bar (5.4...5.6 kgf/cm²)
1.5 Leak test **D17**	
Minimum pressure	
after 10 minutes:	2.0 bar (2.1 kgf/cm²)
after 20 minutes:	1.7 bar (1.8 kgf/cm²)
1.6 Injection valves **E13**	
Opening pressure:	3.0...4.1 bar (3.1...4.2 kgf/cm²).

* Pressures in the test-specification table are given in bar (gauge pressure) and in kgf/cm² (gauge pressure).

1.8 Fuel distributor

F1

Delivered-quantity comparison:	Setting point cm^3/min	Max. allowable delivery cm^3/min
Idle	6.0	6.8
Part load	40.0	44.0
Full load	160.0	175.0

F12

1.7 Idle adjustment*

Note: engine oil temperature approx. 80°C

Idle speed

All models: 900 min^{-1}

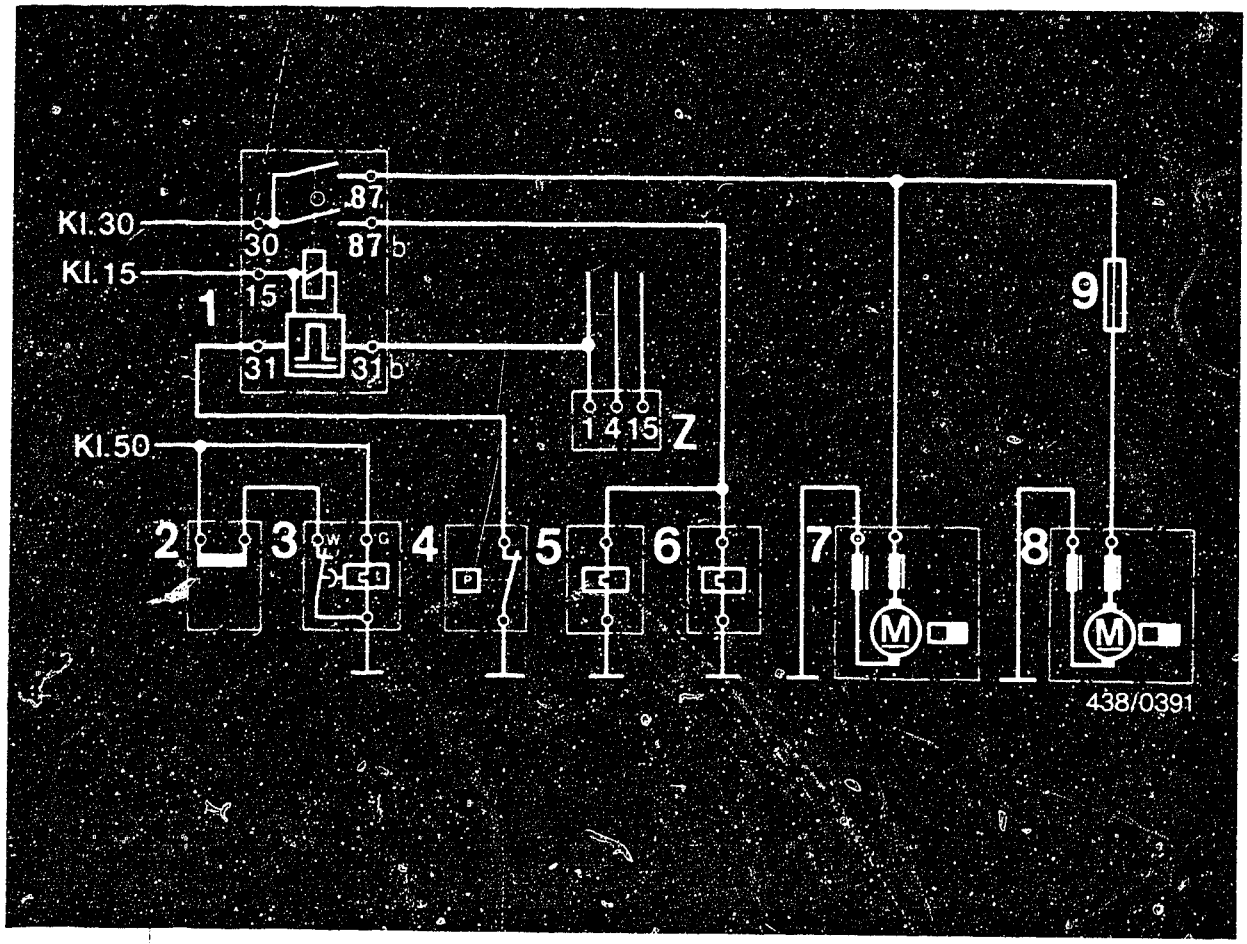
CO content (vol.%):**
Checking value

All models: 2.0%

Setting value
All models: 2.0%

*Note: Swedish and Australian models are equipped with a "pulse-air" system. This should be switched off during idle testing and adjustment: In addition, disconnect the hose between the pulse-air valve and the air filter at the air filter and seal it tightly with a plug.

**Engines whose CO values lie within the checking tolerance and which have an otherwise perfect true running do not have to be adjusted.
If the CO value is outside the checking tolerance, adjust to setting value.

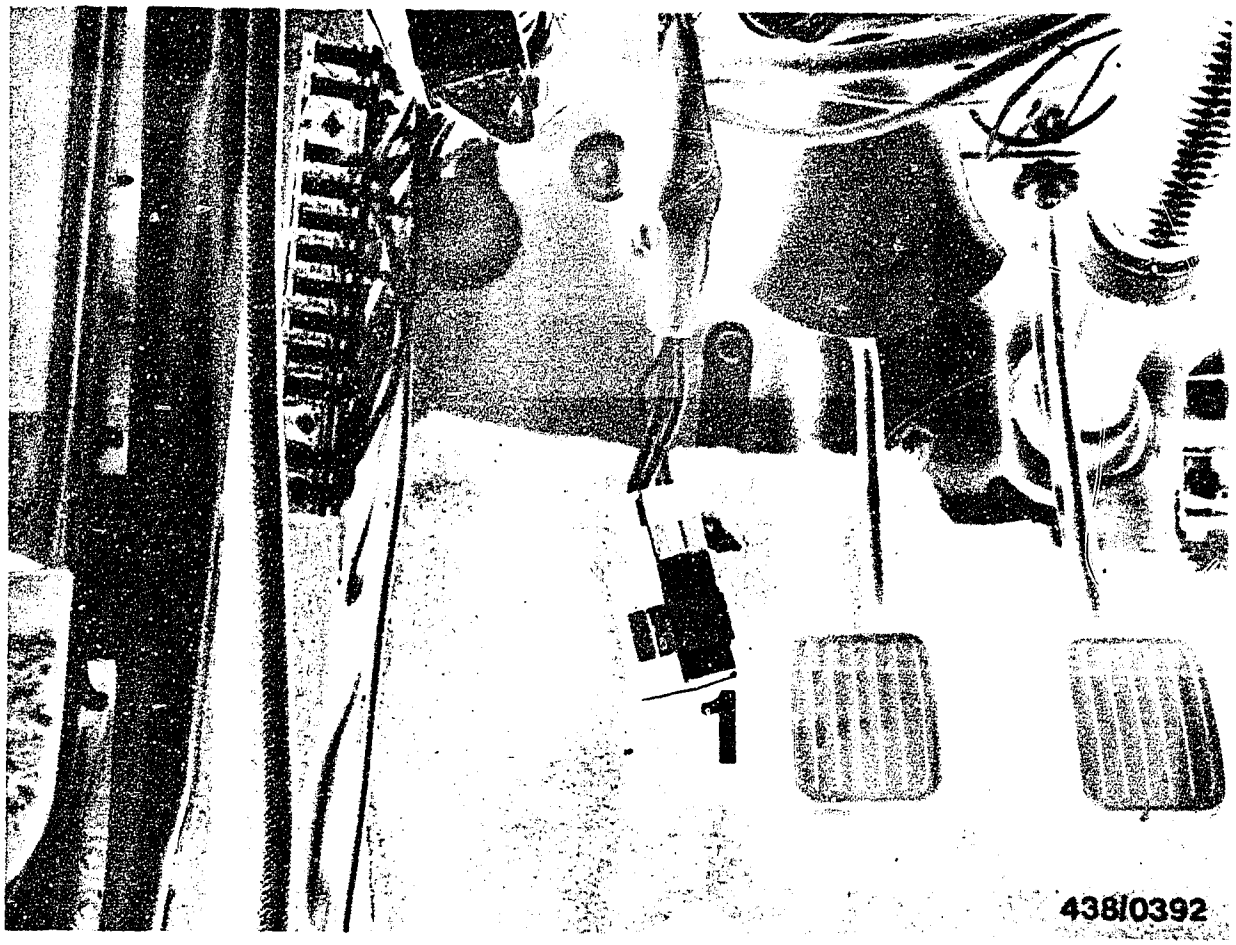


2. Electrical safety circuit

The safety circuit employs an electronic relay which is triggered from terminal 1 of the ignition coil.

2.1 Diagram

1 = Electronic speed switch
2 = Cold-start valve
3 = Thermo-time switch
4 = Charge-air pressure switch (safety switch)
5 = Warm-up regulator
6 = Auxiliary-air device
7 = Electric fuel pump
8 = Pre-supply pump
9 = Fuse (in main fuse box)
Z = Ignition coil

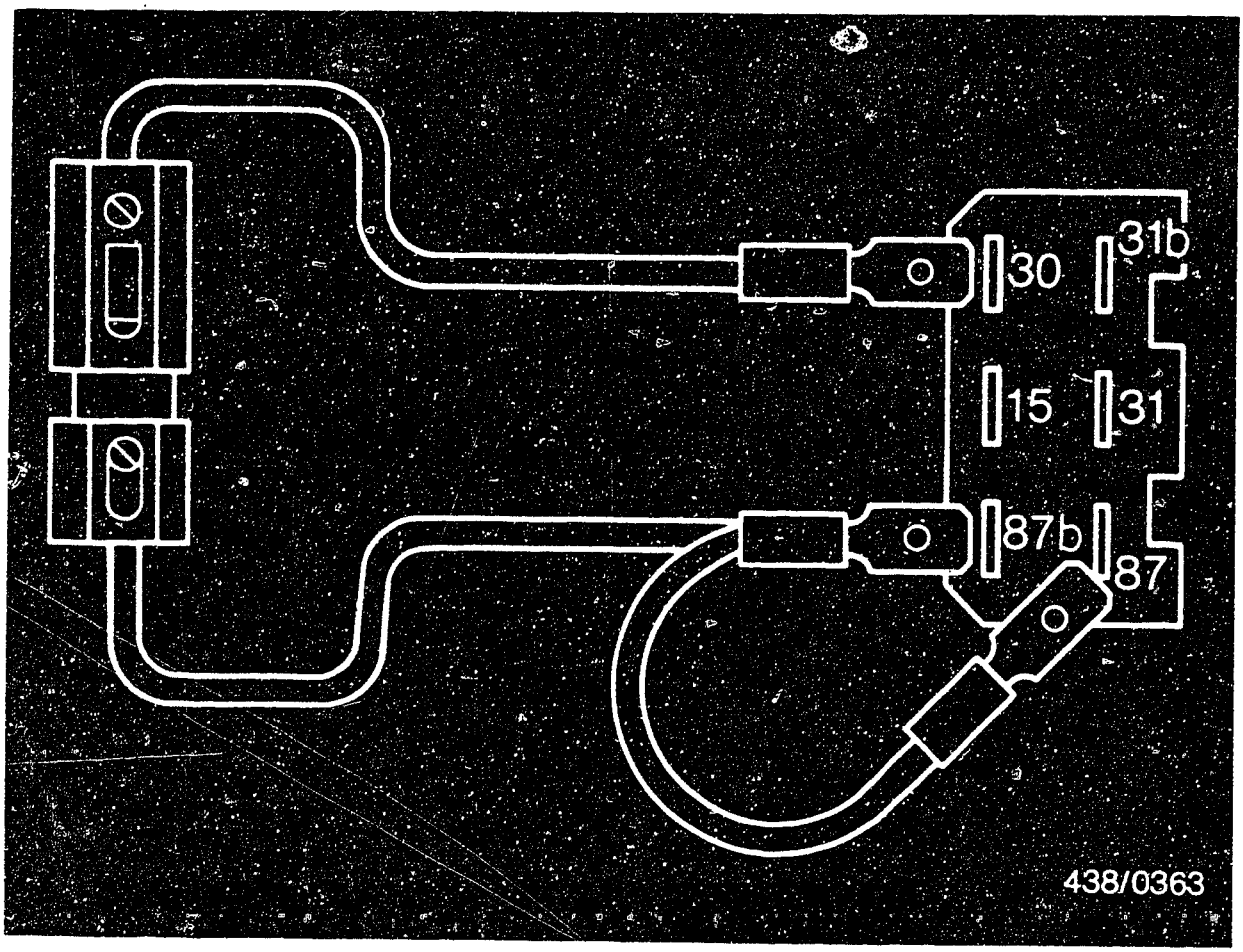


2.2 Bridging the safety circuit

In order to carry out testing with the engine stationary, it is necessary to bridge the safety circuit.

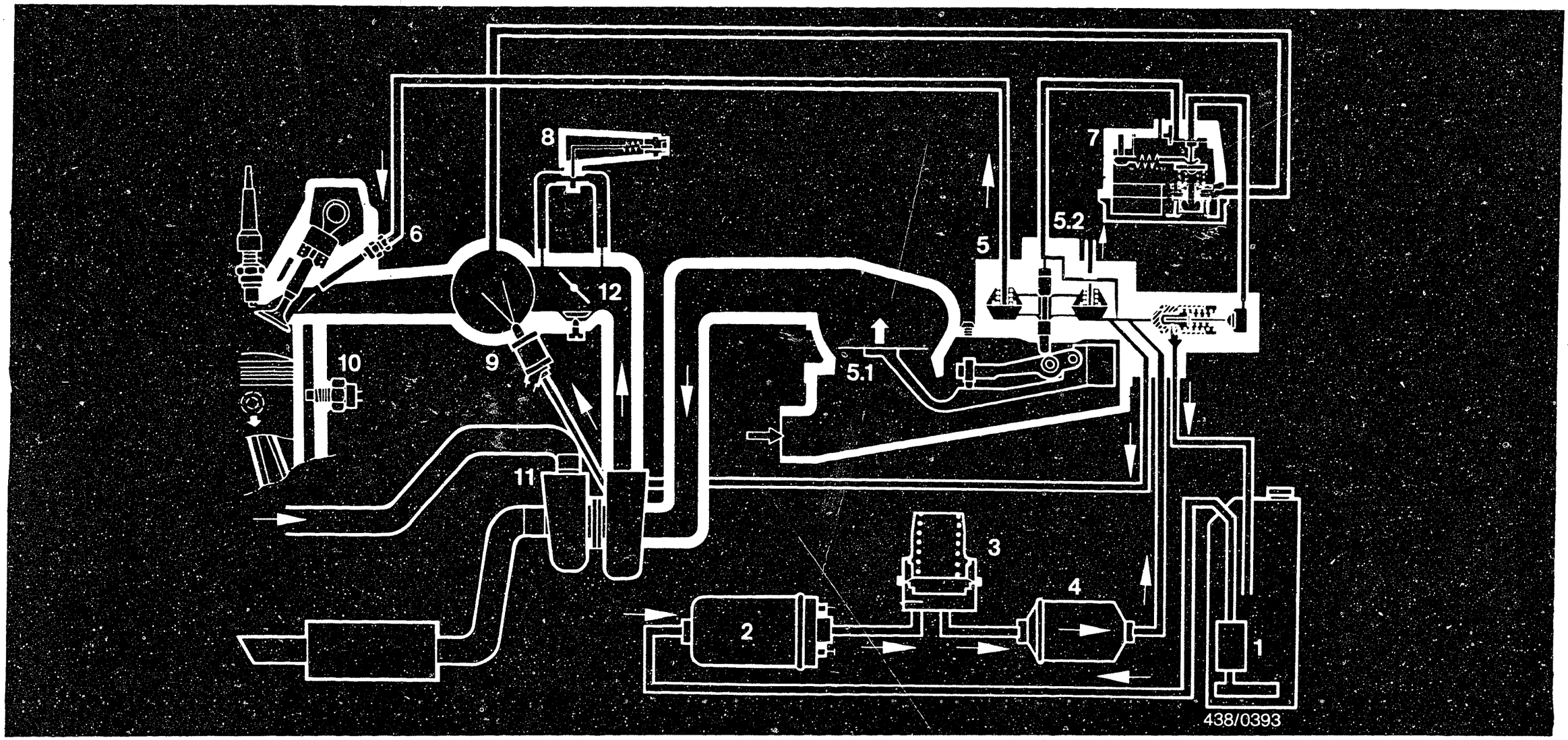
The relay (1) is mounted on a holder to the left of the steering column beneath the instrument panel (the picture shows it released from the mounting). To bridge the safety circuit, remove relay.

The relay can be reached by removing the left-hand lower panel of the instrument panel and the left-hand side panel in the foot well.



Connect contacts 87 and 87b with contact 30 in the base by means of a double bridge.
Use connecting cable 1.5 mm² with fuse element and 16 A fuse.

Electric fuel pump, pre-supply pump, warm-up regulator and auxiliary-air device are now supplied with battery voltage.



3. Diagram of fuel lines

1 = Pre-supply pump (in fuel tank)
2 = Electric fuel pump
3 = Fuel accumulator
4 = Fuel filter
5 = Mixture-control unit
5.1 = Air-flow sensor
5.2 = Fuel distributor
6 = Injection valve
7 = Warm-up regulator
8 = Auxiliary-air device
9 = Cold-start valve
10 = Thermo-time switch
11 = Turbo-supercharger
12 = Throttle valve

4. General information

4.1 Introduction

These repair instructions refer to the Volvo 240 with B 21 ET (T = Turbo) engine as from 1981, i.e. as from commencement of series production.
A concise description of the testing and adjustment operations to be performed on the vehicle on the K-Jetronic is given. All the system components are dealt with in separate working steps with the corresponding test specification.

In addition to these repair instructions the appropriate testing and repair instructions will, of course, be issued for every other vehicle type equipped with the K-Jetronic.

The K-Jetronic differs from other known fuel-injection systems in terms of both construction and operation. In order to be able to carry out the testing procedures described in these instructions - and therefore to be able to assess the components - the K-Jetronic and its operation should be clearly understood. The essential points of the operation and construction of the K-Jetronic are described in Technical Instruction VDT-U 3/1 En.

4.2 Design of K-Jetronic:

The entire system of the K-Jetronic in the Volvo 240 with B 21 E-Turbo engine corresponds to the basic design as described in the Technical Instruction VDT-U 3/1.

4.3 Different or additional components:

- Pre-supply pump (produced by outside manufacturer) is mounted in the fuel tank. When checking the electric fuel pump (checking the fuel delivery), the possible influence of the pre-supply pump should be taken into account.
- 4-cylinder fuel distributor in 6-cylinder engine due to large fuel delivery, two outlets are closed by filler plugs.
- Warm-up regulator in version for charge-air-pressure controlled full-load enrichment.

The function of this warm-up regulator is in principle the same as that of the familar version for manifold pressure controlled full-load enrichment. Enrichment (reduction in control pressure) does not take place during induction operation of the engine, but only when there is charge-air pressure (gauge pressure) in the intake manifold.

● Electrical safety circuit:

As with the other Volvo models, the electrical safety circuit employs an electronic relay which is triggered from connection 1 of the ignition coil.
In addition, the Turbo model has a charge-air pressure switch which is closed during normal operation and forms the earth connection to terminal 31 of the electronic relay.
The switch opens and thus breaks the earth connection to the relay if the charge-air pressure for some reason (e.g. defective charge-air pressure regulator) becomes too high. The electric fuel pump is thus switched off and the supply of fuel cut off.
The switching point is approx. 0.9 bar gauge pressure.

● Further equipment:

Vehicle models for Sweden and Australia are equipped with an exhaust-gas afterburning system according to the "pulse-air" system.
In this system unburnt gases in the exhaust gas are subject to afterburning by flushing with air and thus a reduction in the amount of pollutants in the exhaust gas is achieved.
The system does not operate with secondary air pumps but uses the pulsation in the change between gauge pressure and vacuum in the exhaust system.
When there is a vacuum, additional air is sucked into the exhaust manifold.
When there is gauge pressure, non-return valves stop exhaust gas returning to the air filter.

5. Test equipment and tools

5.1 Pressure tester KDJE-P 100 (previously KDEP 1034).
For testing all fuel pressures and testing for leaks.

5.2 Connecting-parts set KDJE-P 100/10 (previously KDEP 1034/10).
For connecting pressure tester.

5.3 Adjusting wrench KDEP 1035
For adjusting the idle-mixture-adjusting screw in the mixture-control unit (idle adjustment).

5.4 Guide ring KDEP 1040/10 (Ø 80 mm).
For centring the air-flow sensor plate in the air-flow sensor.

5.5 Tester for delivered quantity comparison KDJE-P 200 (previously KDJE 7451).
For comparing the fuel delivered from the individual fuel-distributor outlets.

5.6 Graduate (commercially available, capacity approx. 1.5l)
For measuring the delivery of the electric fuel pump.

5.7 Electrical connection lead (test lead).
KDJE 7450/70 for direct connection to components to be tested, e.g. cold-start valve.

5.8 Tool set for removing and fitting the idle-speed anti-tamper device of the air flow sensor
(e.g. No. 4521/7 from Hazet Co., 5630 Remscheid).

5.9 Line set KDJE-P 200/25 (previously KDJE 7451/25).
For connecting the tester for delivered quantity comparison KDJE-P 200.

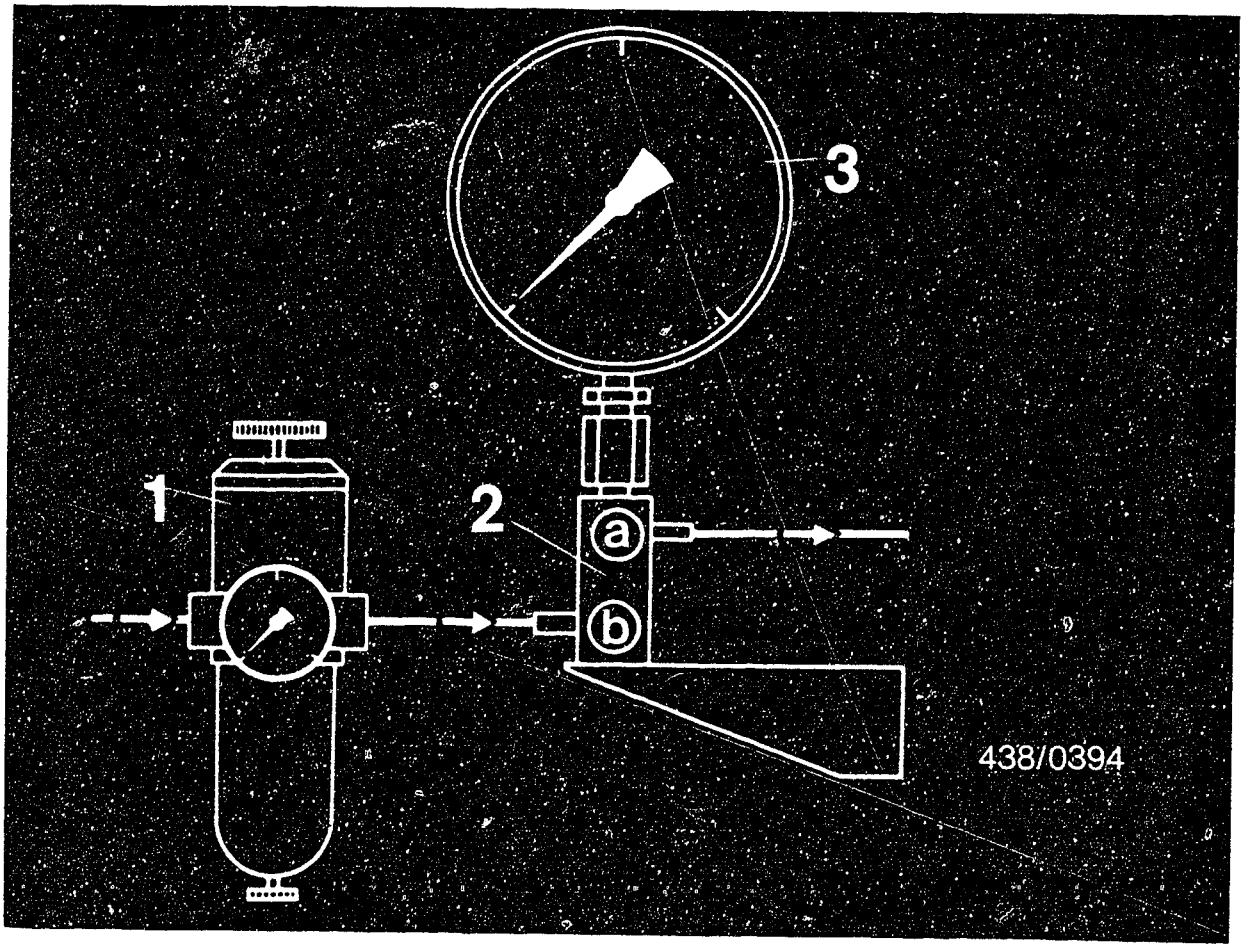
5.10 Valve tester KDJE-P 400 (previously KDJE 7452).
For testing the injection valves.

Test media: Calibrating fluid (Shell K 30, Esso-Varsol, Shell Mineral Spirits 135)
or
Bosch Part Designation VS 14 942-CH
previous Part No. 5 973 340 650
The Bosch calibrating fluid can be obtained in 5 l metal cans from the following supplier:
Firma
Oskar Gnamm GmbH & Co
D-7531 Kämpfelbach-Bilfingen

Caution:
For safety reasons, never use normal gasoline or similar easily inflammable and combustible liquids.
Even with calibrating fluid, be sure to observe the local official regulations.

5.11 Tachometer (commercially available).
For idle-speed adjustment.

5.12 CO meter (commercially available).
For idle-speed CO adjustment.



5.13 Testing device for full-load control pressure consisting of:

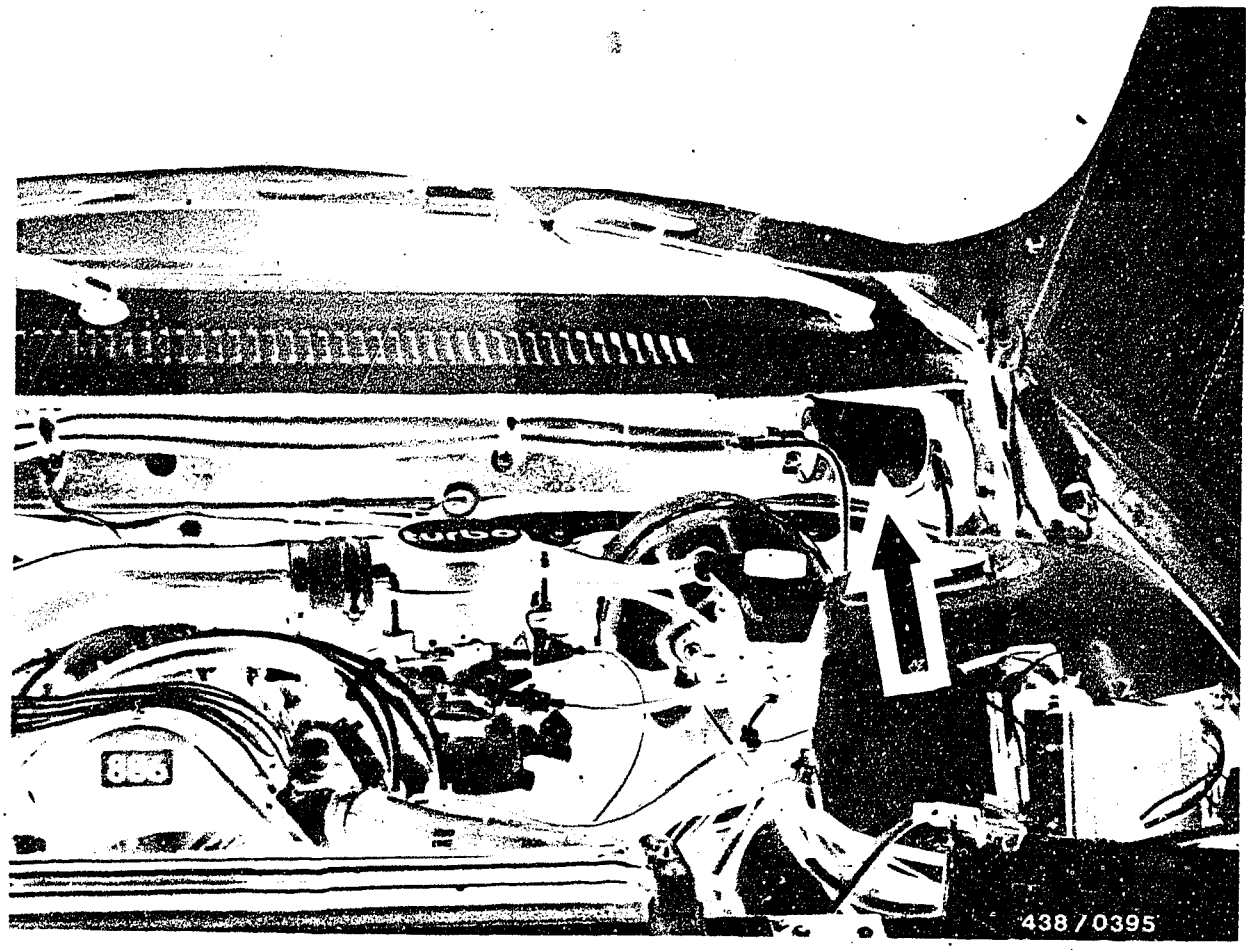
Pressure-reducing valve (1) with pressure gauge 0...4 bar gauge pressure (commercially available, e.g. type No. 104, Krais and Fritz, Stuttgart).

Regulator (2)
Bosch 0 688 130 132.

Pressure gauge (3) 0...1.6 bar gauge pressure, quality class 1.0 (commercially available, e.g. Wika No. 4184).

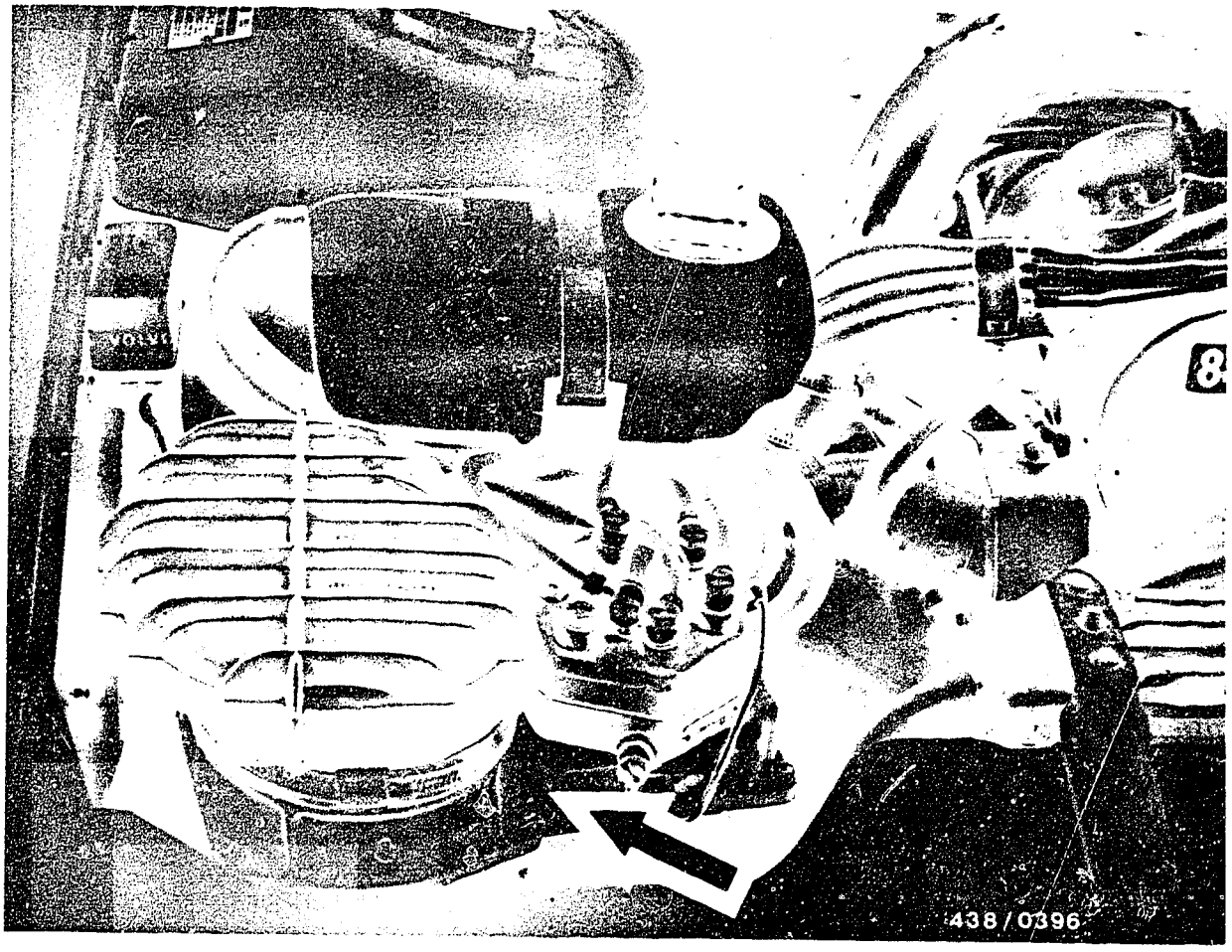
To test the full-load control pressure, atmospheric pressure must be applied to the warm-up regulator in accordance with the charge-air pressure. This is done using the compressed air network.

Note:
The equipment specified is often already available in the diesel workshop and is used there for testing the manifold-pressure compensators on diesel fuel-injection pumps.

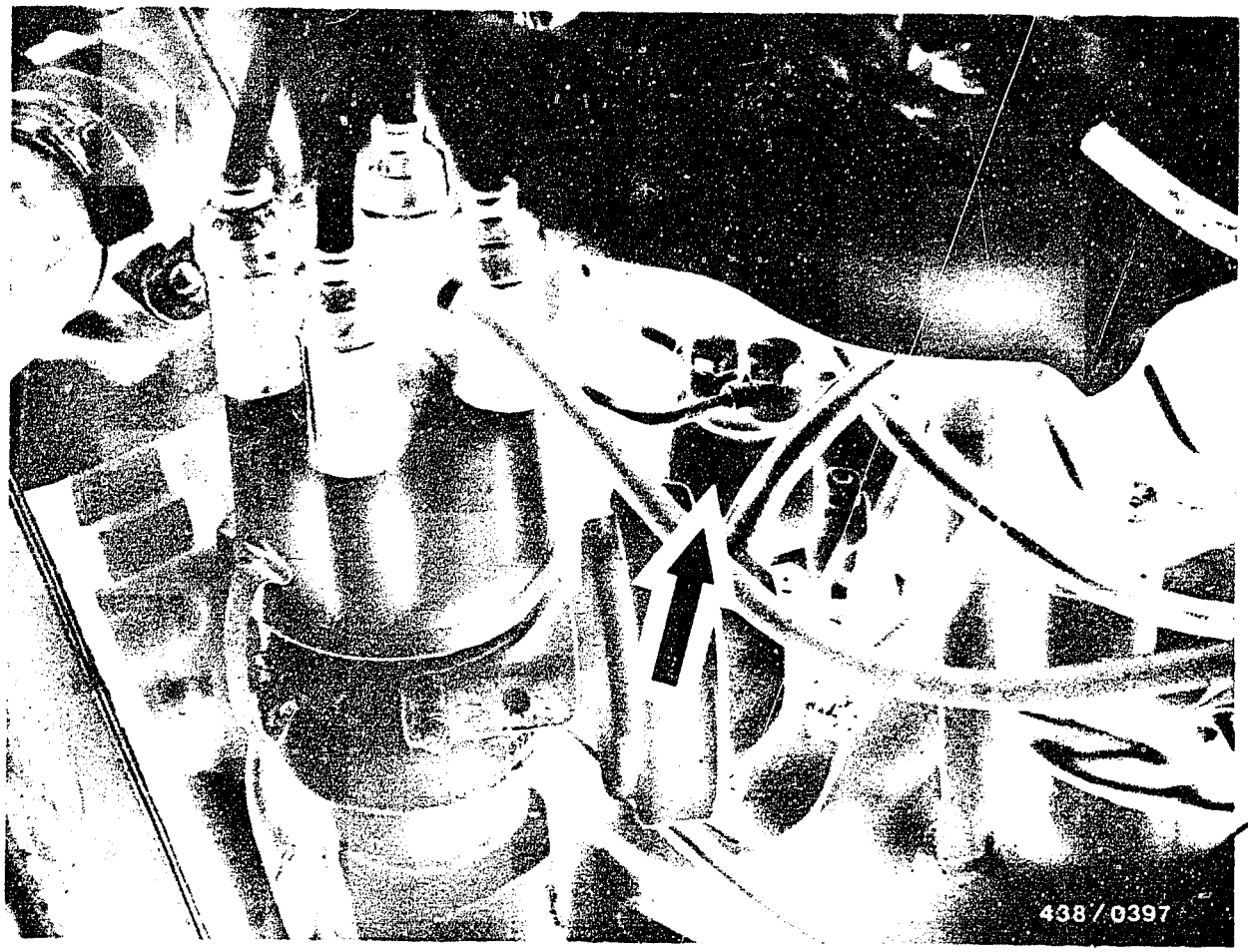


6. Installation position of individual components

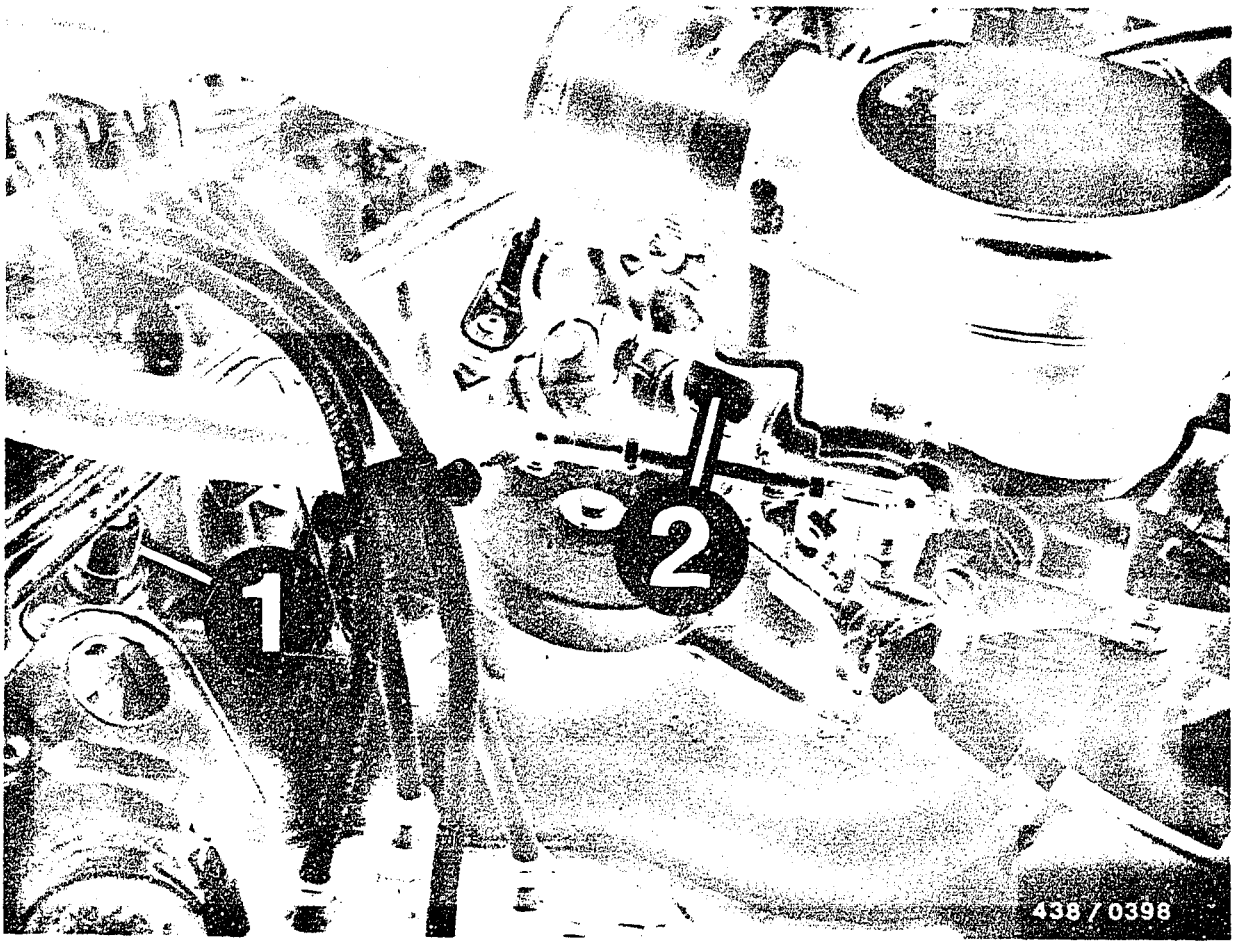
As in the other Volvo models, the fuel filter (arrowed) is situated on the firewall, on the left-hand side in the direction of travel.



The mixture-control unit is mounted on the air filter housing (arrowed).
The fuel distributor is a six-cylinder version due to large fuel delivery; 2 outlets are closed with filler plugs.



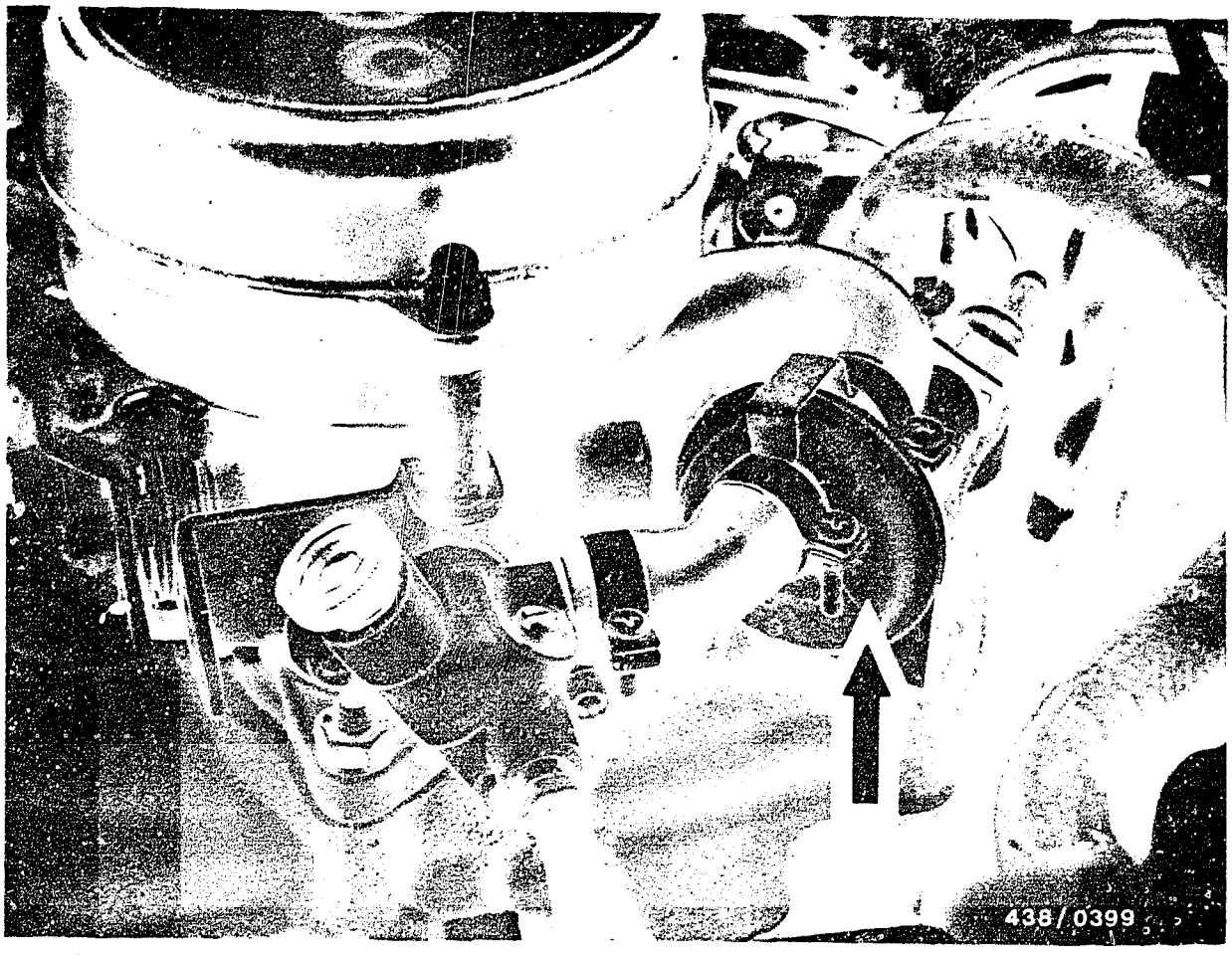
The warm-up regulator is mounted on a bracket on the engine block beneath the air-intake tube of cylinder 2 (arrowed).



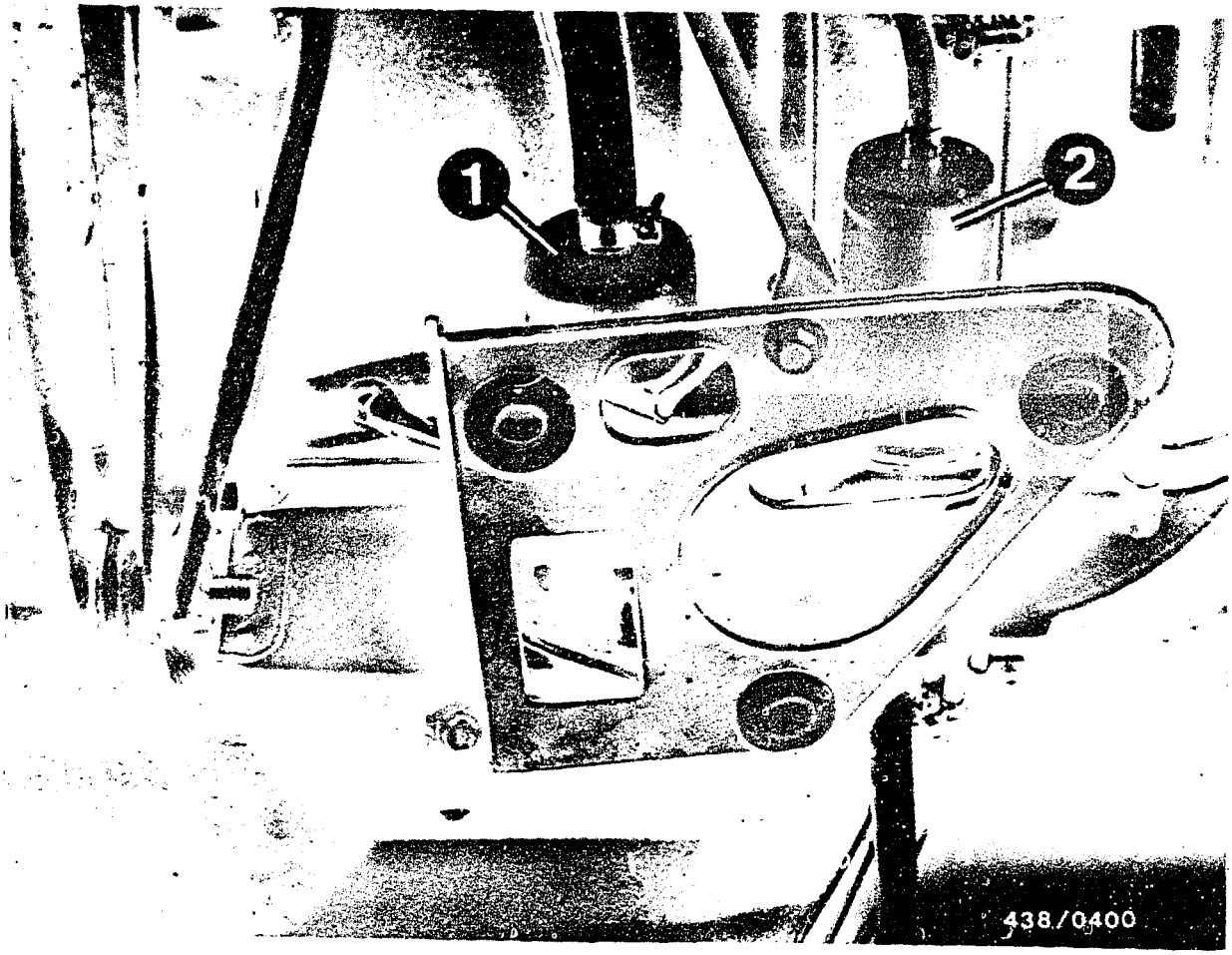
The injection valves (1) are inserted and are fixed by retaining plates. Before removing the injection valve, unscrew the steel fuel-injection lines taking care, if possible, not to bend them.

The cold-start valve (2) is mounted in the throttle-valve housing.

The thermo-time switch (not visible in picture) is screwed into the flange of the air intake tube of cylinder 4 at the cylinder head.
Caution: Remove if possible only when the engine is cold, since some coolant escapes. If the engine was warm, the amount of coolant escaping would be considerably greater.



Auxiliary-air device (arrow)



On the vehicle floor, on the left, in front of the rear axle, as viewed in the direction of travel, there is a bracket on which the electric fuel pump (1) and the fuel accumulator (2) are mounted.

7. Trouble-shooting chart (see also coordinates B3/B4)

Customer complaint (fault symptom)

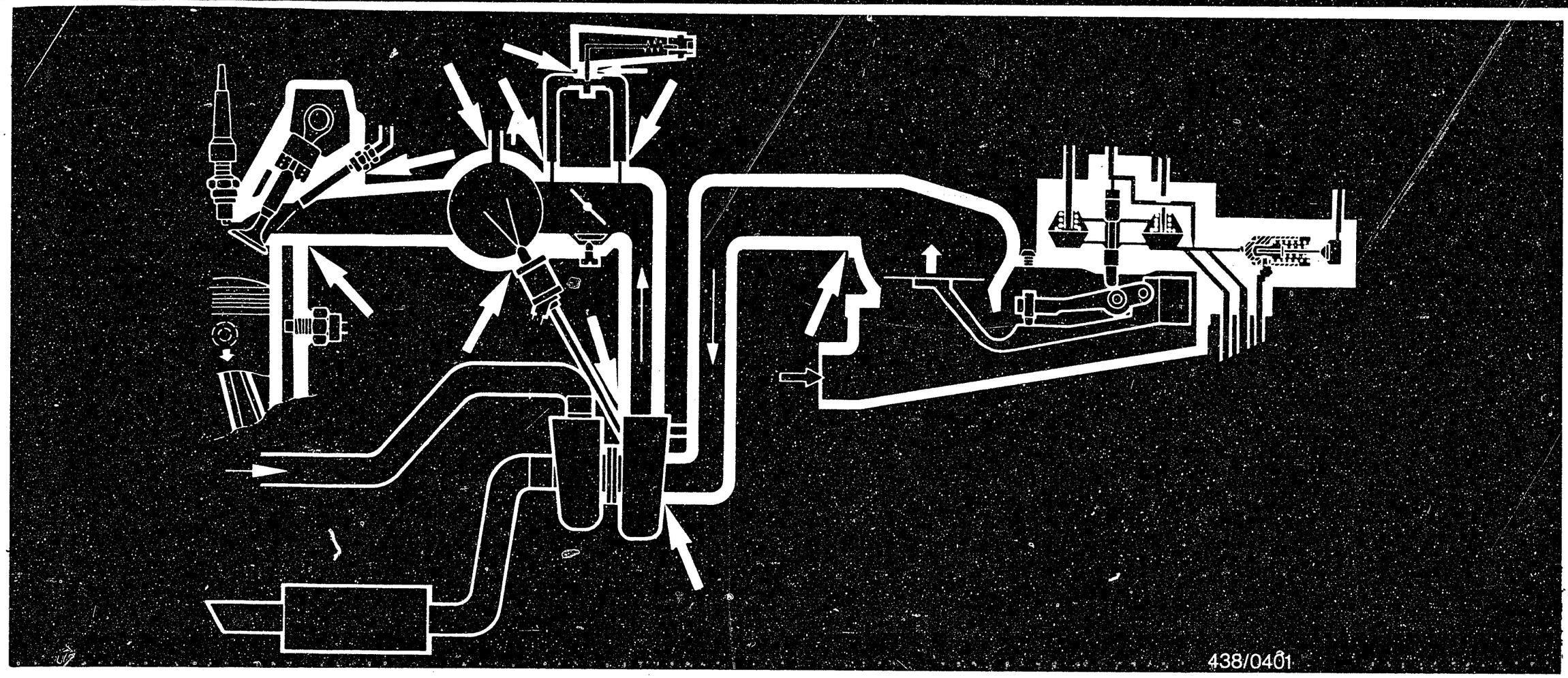
1. Engine does not start, or starts poorly, in cold condition
2. Engine does not start, or starts poorly, in warm condition*
3. Irregular idling during the warm-up phase (shakes)
4. Irregular idling with warm engine (shakes)
5. Engine does not draw gas, burbles
6. Engine misfires when operating on the road, high load
7. Insufficient power

*Note
If, in the case of Symptom 2, after checking and repairing all the fault causes listed below, the hot-start characteristic is still unsatisfactory this can be improved by fitting an impulse relay.
The fitting of this relay is described in Coordinate L 3.

1	2	3	4	5	6	7	Cause	Coordinates
	●	●	●	●		●	Vacuum system leaking	B 5
●	●		●	●	●	●	Air-flow sensor lever and/or control plunger not moving smoothly	B 7
	●						Position of the air-flow sensor plate incorrect	B15
●		●					Auxiliary-air device does not open	B18
							Auxiliary-air device does not close	B18
●	●				●		Electric fuel pump not operating	B20
●							Cold-start system defective	C 6
		●	●				Cold-start valve leaking	C 8
				●			Excessive fuel delivery for control-pressure circuit	C14
●		●					"Cold" control pressure outside tolerance	C12
	●		●	●	●	●	"Warm" control pressure too high (after warm-up)	C12
			●	●		●	"Warm" control pressure too low (after warm-up)	C12
					●	●	Primary (system) pressure outside tolerance	D10
	●						Overall fuel system leaking	D17
●	●	●	●		●		Injection valves leaking, opening pressure too low	E13
●	●	●	●			●	Unequal fuel delivery (imbalance of fuel delivery)	F 1
●	●	●	●	●			Basic idle adjustment incorrect	F12
						●	Throttle plate does not open completely	-
						●	Turbocharger or charge-air pressure regulator defective	-

Customer complaint (fault symptom) (continued)

8. Engine runs on after being switched off ("diesels")	9. Fuel consumption too high	10. Flat spot during acceleration	11. CO concentration during idling too high	12. CO concentration during idling too low	13. Idle-speed cannot be adjusted (too high)	14. Engine starts but then immediately stops	Cause	Coordinates
		●		●			Vacuum system leaking	B 5
●		●	●	●			Air-flow sensor lever and/or control plunger not moving smoothly	B 7
●							Position of the air-flow sensor plate incorrect	B15
							Auxiliary-air device does not open	B18
					●		Auxiliary-air device does not close	B18
						●	Electric fuel pump not operating	B20
							Cold-start system defective	C 6
●	●		●				Cold-start valve leaking	C 8
		●				●	Excessive fuel delivery for control-pressure circuit	C14
							"Cold" control pressure outside tolerance	C12
		●				●	"Warm" control pressure too high (after warm-up)	C12
	●	●	●			●	"Warm" control pressure too low (after warm-up)	C12
		●				●	Primary (system) pressure outside tolerance	D10
							Overall fuel system leaking	D17
●							Injection valves leaking, opening pressure too low	E13
		●					Unequal fuel delivery (imbalance of fuel delivery)	F 1
●	●	●	●	●			Basic idle adjustment incorrect	F12
							Throttle plate does not open completely	-



Working steps

8 Check the air guide system of the engine for leaks.

The arrows in the diagram show typical points where leaks can occur.
Check by performing a visual inspection or, in cases of doubt, as follows: Disconnect the hose from the outlet of the auxiliary-air device and blow air through this hose into the air guide system using a compressed-air gun. The throttle valve is to be fully open. Brush connection points with soapy water, or spray with leak detector (e.g. Güpoflex).

Under no circumstances may combustible liquids be used when testing for leaks.
The formation of bubbles or foam indicates a leak.
If a leak has been eliminated, it is necessary finally to adjust the idle speed with the engine at normal operating temperature:
Idle-speed adjustment is described on Cordinates F12.

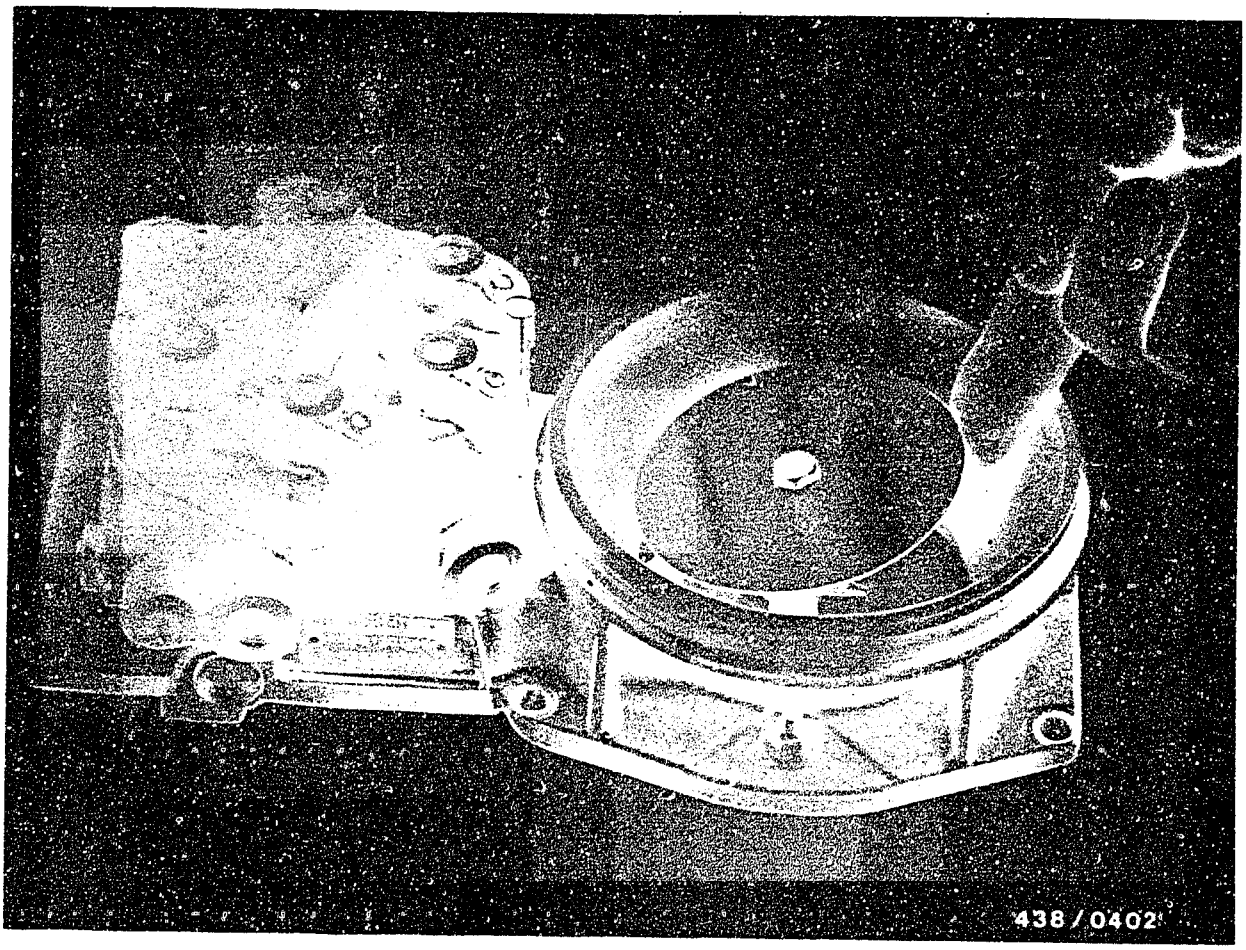
9. Check the control lever in the air-flow sensor and the control plunger in the fuel distributor for ease of movement.

9.1 Preparations

Engine temperature not below +20°C

Remove the rubber dome from the air-flow sensor so that the air-flow sensor plate becomes accessible.

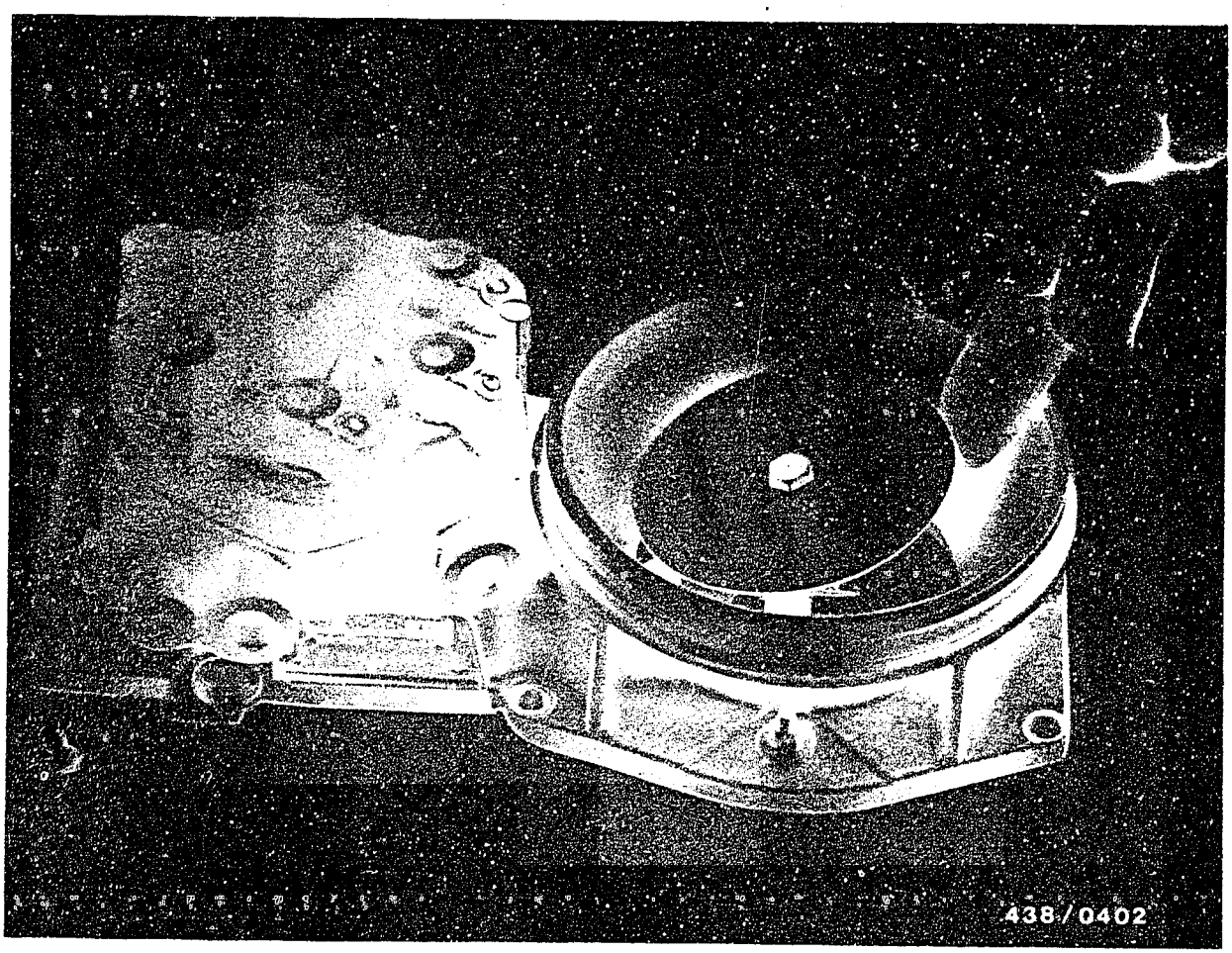
Switch on the electric fuel pump for approx. 10 seconds by bridging the safety circuit.
This results in application of the control pressure to the control plunger in the fuel distributor.



9.2 Check that the control lever moves freely

Lift the air-flow sensor by hand and let it drop.
The sensor plate snaps back into the zero position and bounces up about twice from the spring-loaded stop.
If the control lever does not move freely, first release all fastening screws holding the air-flow sensor to determine whether housing deformation is the cause of the problem.
If the control lever moves freely once the fastening screws are released, then the seal between the air filter and the air-flow sensor should be changed (Volvo replacement part).
Tighten the screws uniformly cross-wise.

If the housing is not deformed, then the air-flow sensor must be repaired or replaced.



9.3 Check that the control plunger moves freely

Lift the air-flow sensor plate by hand. Equal resistance should be felt the whole time.
Move the sensor plate quickly back to just before the zero position.
The control plunger which follows only sluggishly must make noticeable contact with the sensor plate lever. If this happens, then the control plunger can move freely.
If the control plunger does not move freely, remove the fuel distributor from the air-flow sensor.

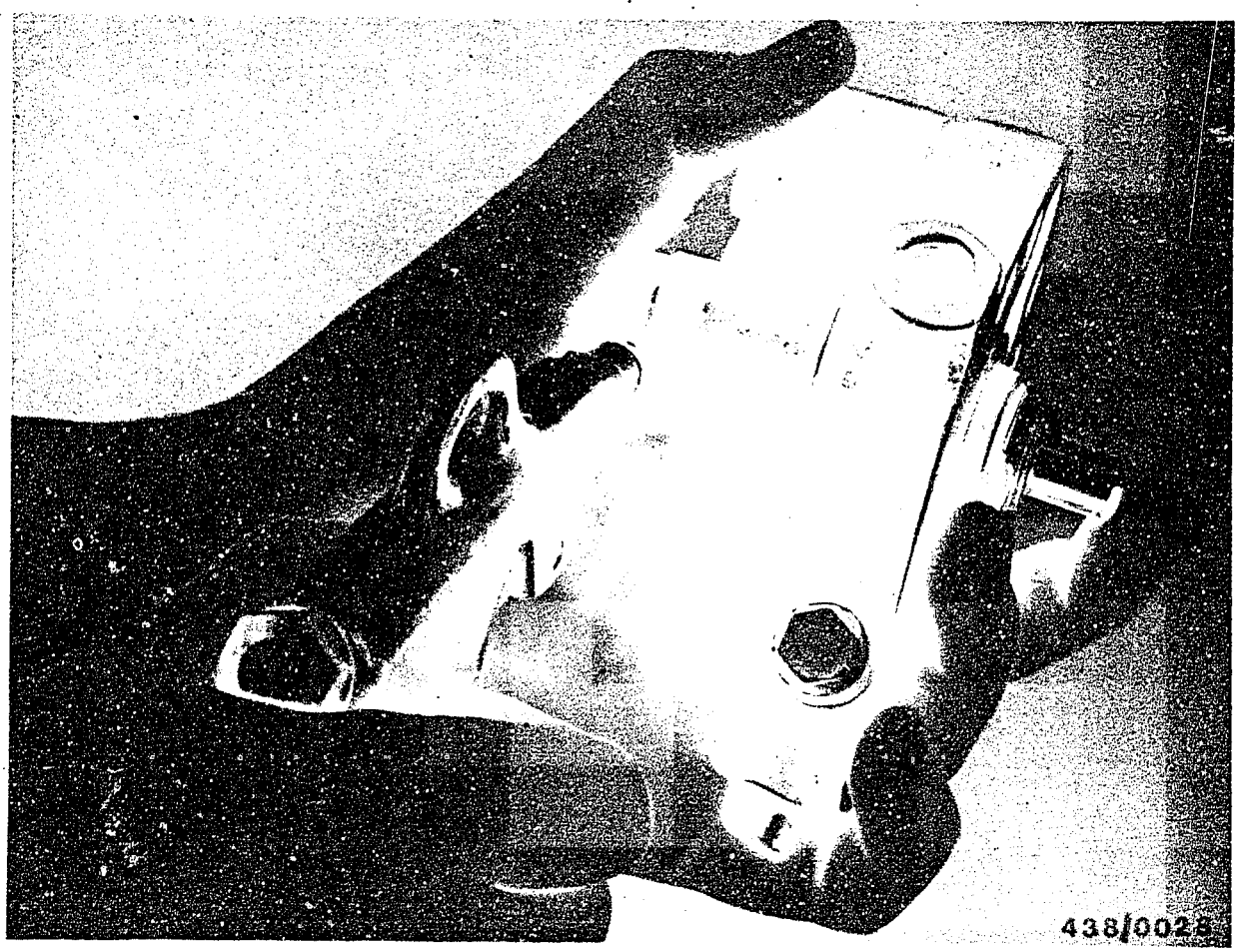
Important!

Note the following when installing fuel components and fuel lines:

Always ensure utmost cleanliness when loosening or tightening the fuel connections. No dirt must enter the fuel system.

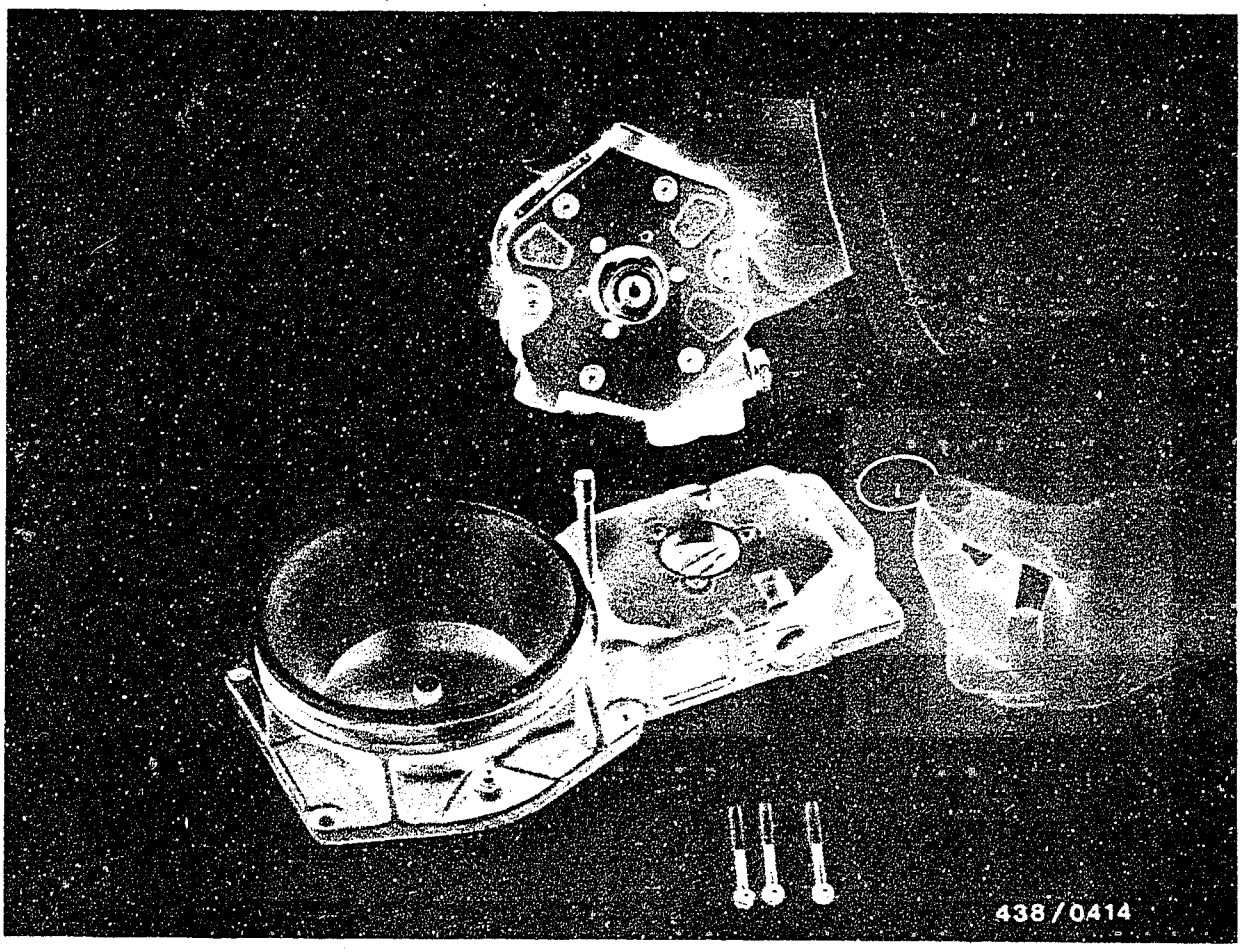
When loosening or tightening the fuel connections, apply counter-force at the fixed hexagon of the component.

Clean the fuel distributor thoroughly in the region of the fuel connections. Screw off all connections.



Screw out three fastening screws and remove the fuel distributor from the air-flow sensor.
The steel tubing must not be bent!

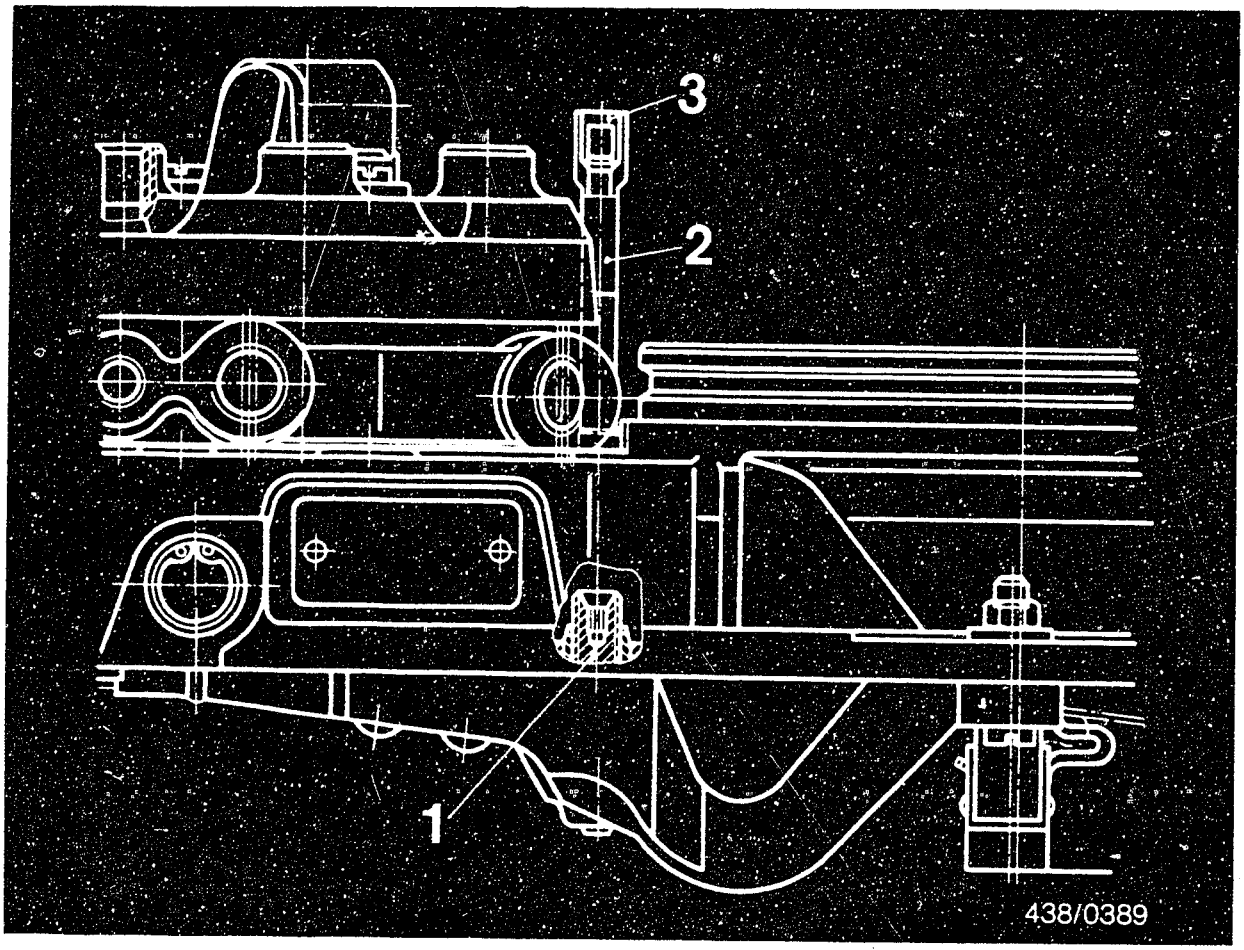
Remove the plunger. Under certain conditions, in order to do this it may be necessary to blow compressed air briefly against the plunger through the control-pressure connection hole. Hold the plunger with your hand while doing this. Clean the plunger thoroughly with benzine. If the plunger still does not move freely, replace the fuel distributor.



9.4 Fitting the fuel distributor

When fitting the fuel distributor, use a new seal ring between fuel distributor and air-flow sensor.
Observe the tightening torque 3.2...3.8 Nm (0.32...0.38 kgfm) for the fastening screws precisely.

When connecting the fuel-injection tubing, use new seal rings.

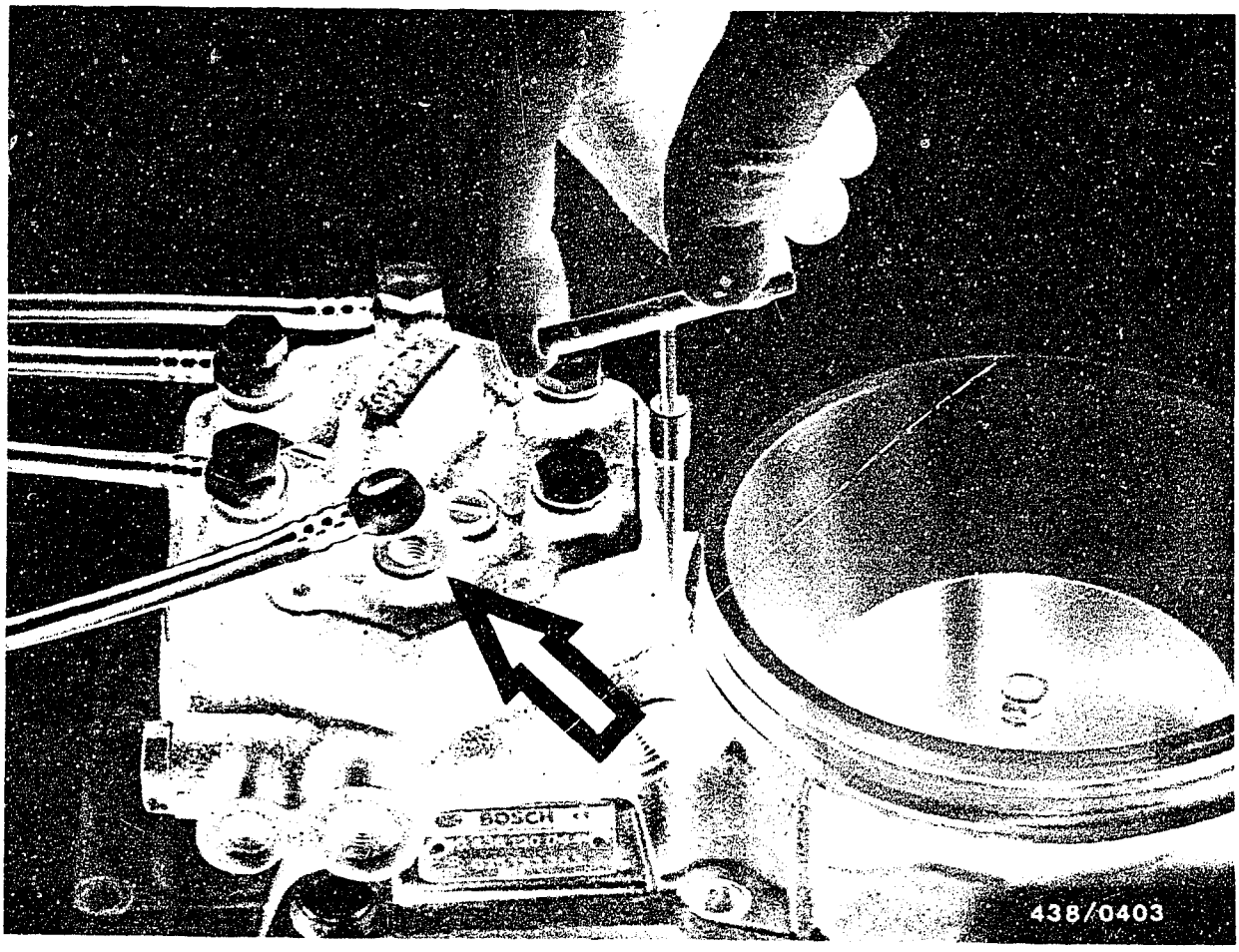


1 = Idle-mixture-adjusting screw
2 = Guide tube
3 = Lead seal

9.6 Matching the fuel distributor to the air-flow sensor for initial starting:

Screw off one fuel-injection line from the fuel distributor.
Bridge the electrical safety circuit so that the electric fuel pump operates.

The idle-mixture-adjusting screw is adjusted via a guide tube rigidly fitted on the mixture-control unit. Remove the lead seal on the idle-mixture-adjusting screw. Insert the adjusting wrench KDEP 1035 through the hole into the idle-mixture-adjusting screw.

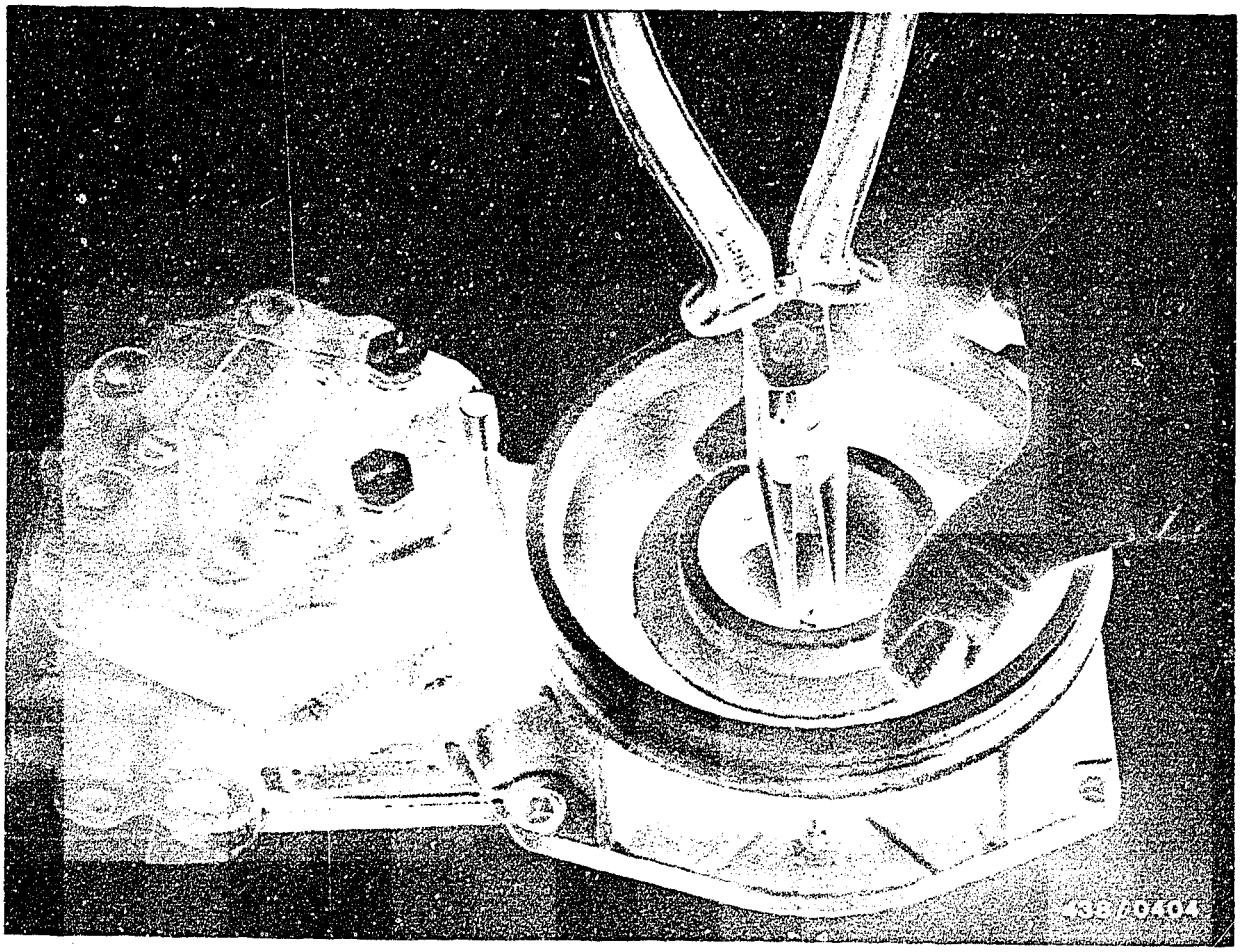


Screw in the idle-mixture-adjusting screw slowly and without exerting any great pressure on the adjusting wrench until fuel is just delivered from the open outlet (arrow) of the fuel distributor. Then turn back the adjusting screw by 1/2 turn.

Re-connect the fuel-injection line to the fuel distributor, start the engine and warm up.

The final matching of air-flow sensor and fuel distributor is carried out by adjusting the idle speed with the engine at normal operating temperature.

Idle-speed adjustment is described on Coordinate F12.



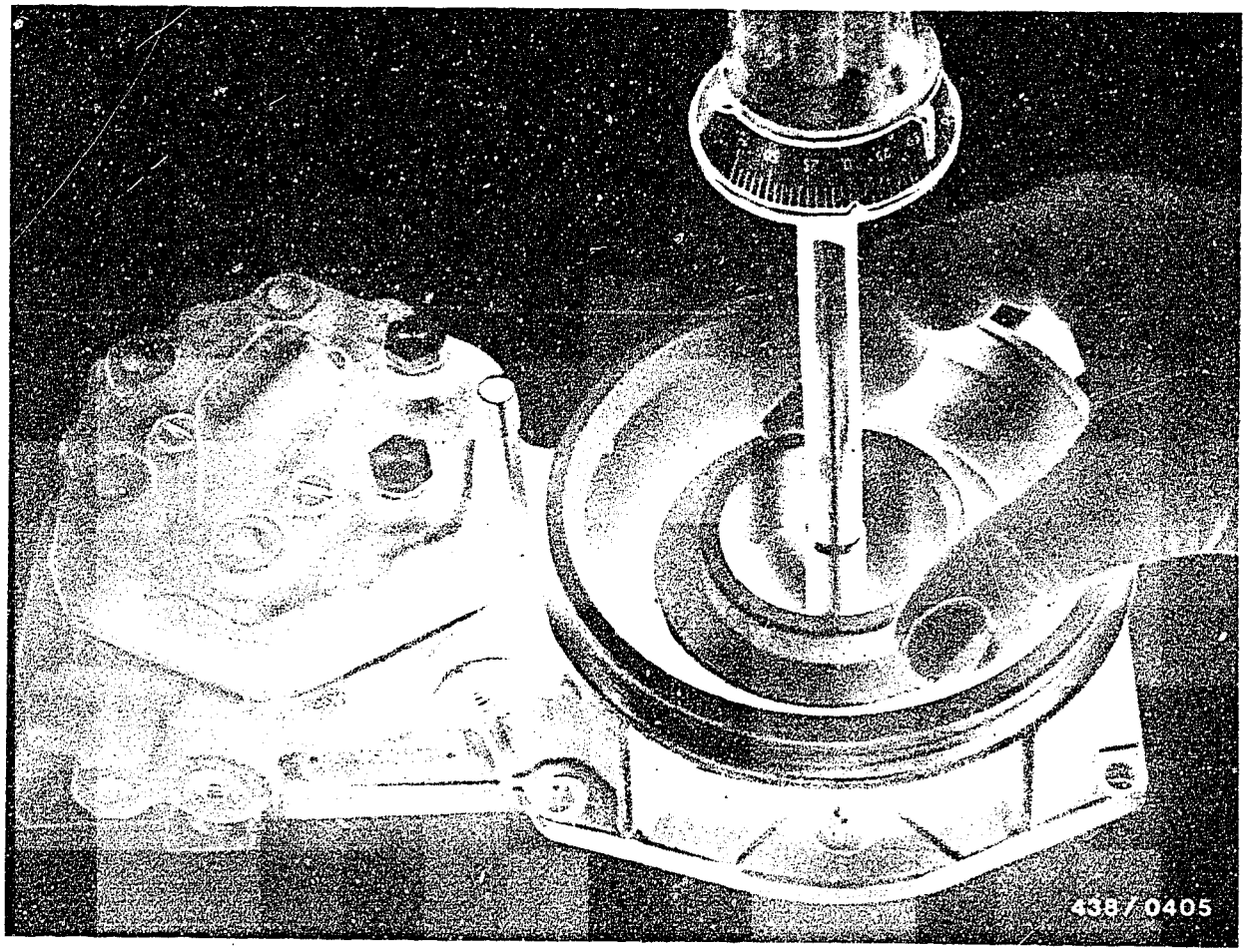
10. Checking and adjusting the position of the air-flow sensor plate

10.1 Preparations

- Engine temperature is not important.
- Remove the rubber dome from the air-flow sensor (loosen clamp) so that the air-flow sensor plate of the air-flow sensor becomes accessible.

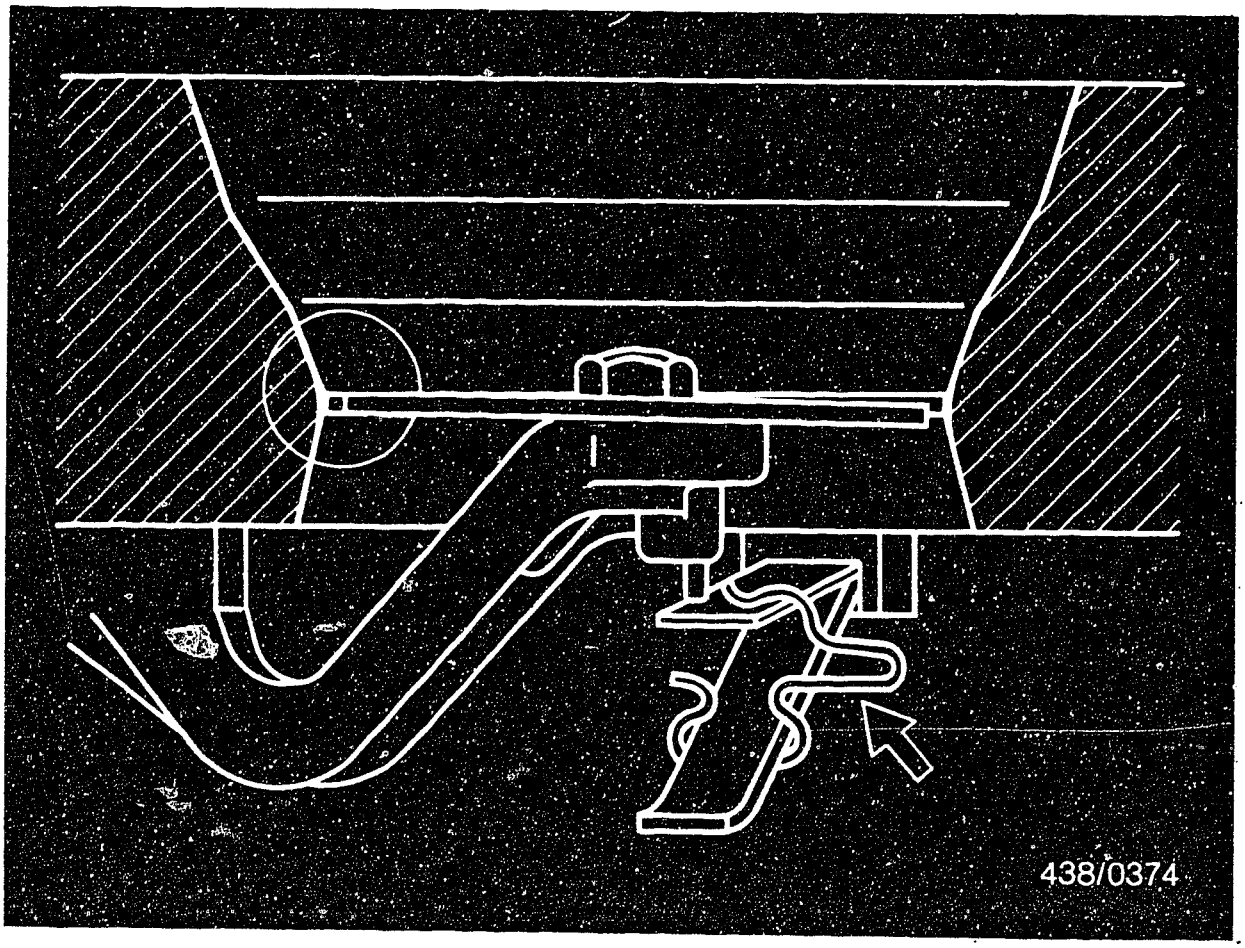
10.2 Centring the air-flow sensor plate

Check that the sensor plate is flat (not bent) and that it can move through the narrowest part of the air funnel without touching the funnel. If necessary, centre it using a positioning ring KDEP 1040/10 (Ø 80 mm) as follows:
Loosen the sensor plate fastening screw. Insert the positioning ring while holding the fastening screws with pliers so that the sensor plate does not deflect downwards.



With the positioning ring in place, tighten the fastening screw with a torque of 5.0...5.5 Nm, loosen again and tighten again with the same torque.
When tightening the screw make sure that the air-flow sensor plate is in its zero position (in the cylindrical part of the air funnel).
It must no longer be possible to turn the air-flow sensor plate by hand.

Caution:
The lower surface of the air-flow sensor plate has been partially chamfered. So that the air-flow sensor plate is correctly mounted, the upper surface is marked either with the word "top" or with five punch marks in a row.

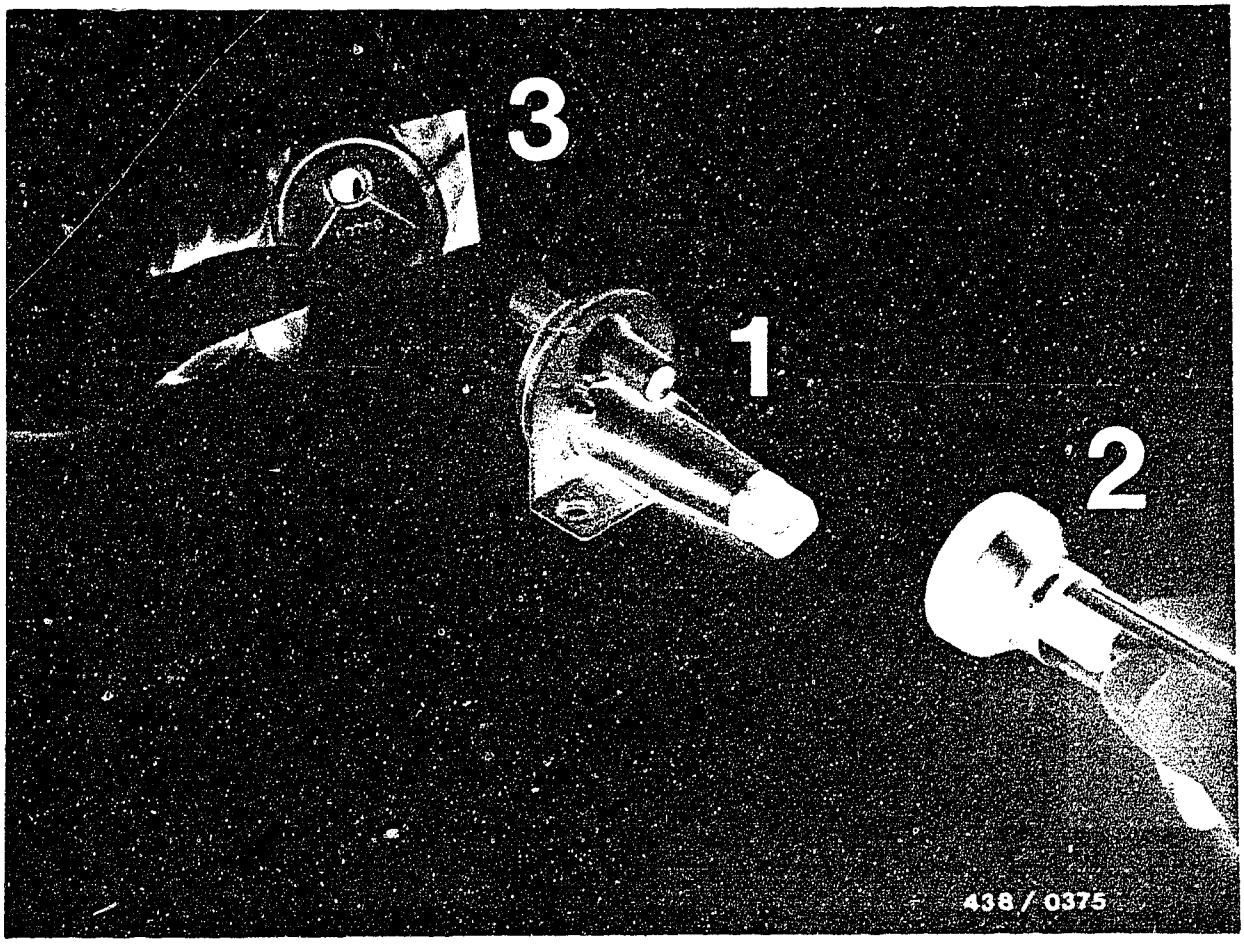


10.3 Checking and adjusting the zero position of the sensor plate (rest position):

Switch on the electric fuel pump for approx. 10 seconds by bridging the safety circuit.
This results in application of the control pressure to the control plunger in the fuel distributor.

The upper edge of the sensor plate must be flush with the edge of the cone at the point shown in the diagram. A maximum of 0.5 mm deeper is admissible, but the sensor plate must not project at any point on its circumference outside the cylindrical part of the air funnel.

If necessary, the position of the stop leaf spring can be corrected by bending the shaped spring (arrowed).

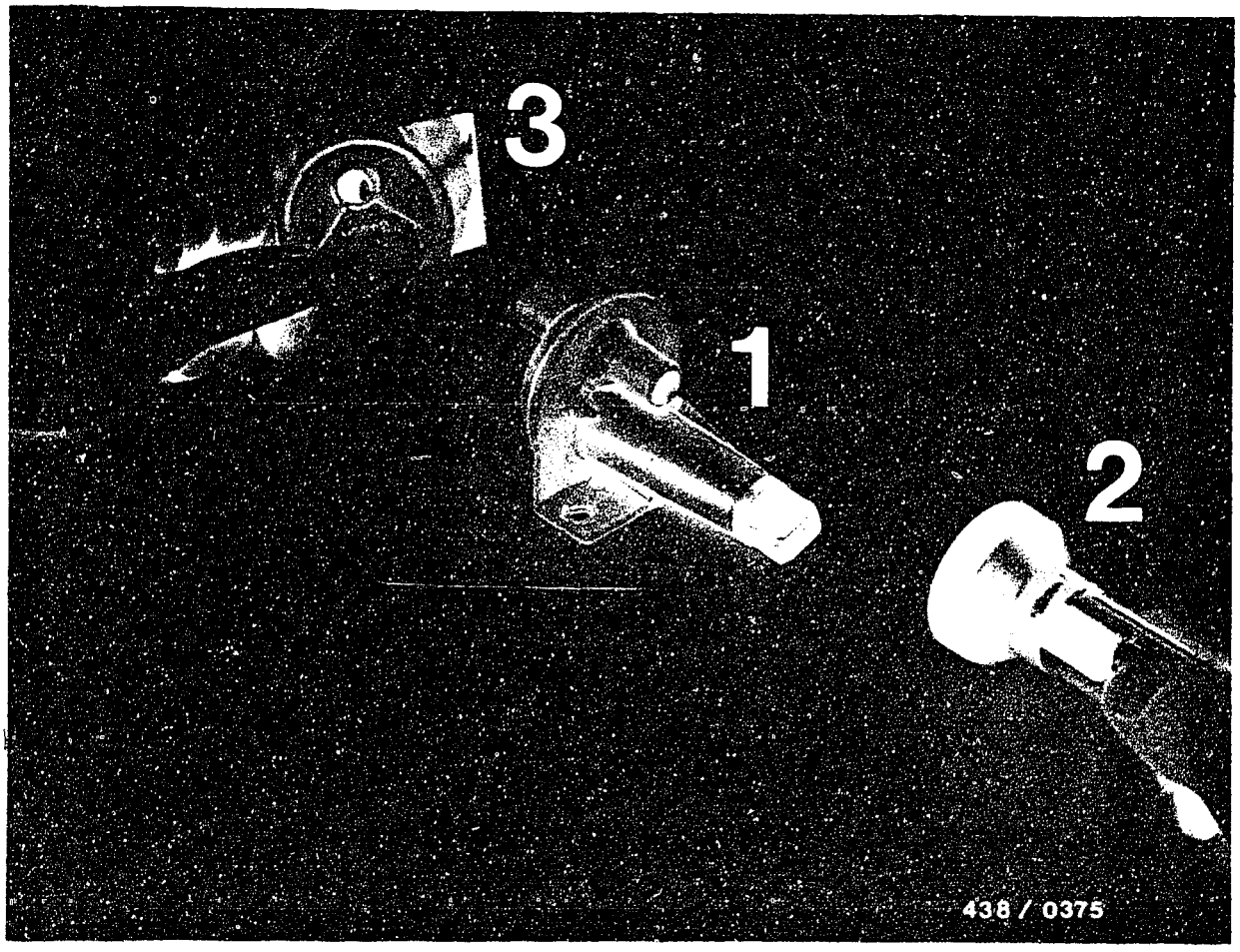


1 = Auxiliary-air device
2 = Flashlight
3 = Mirror

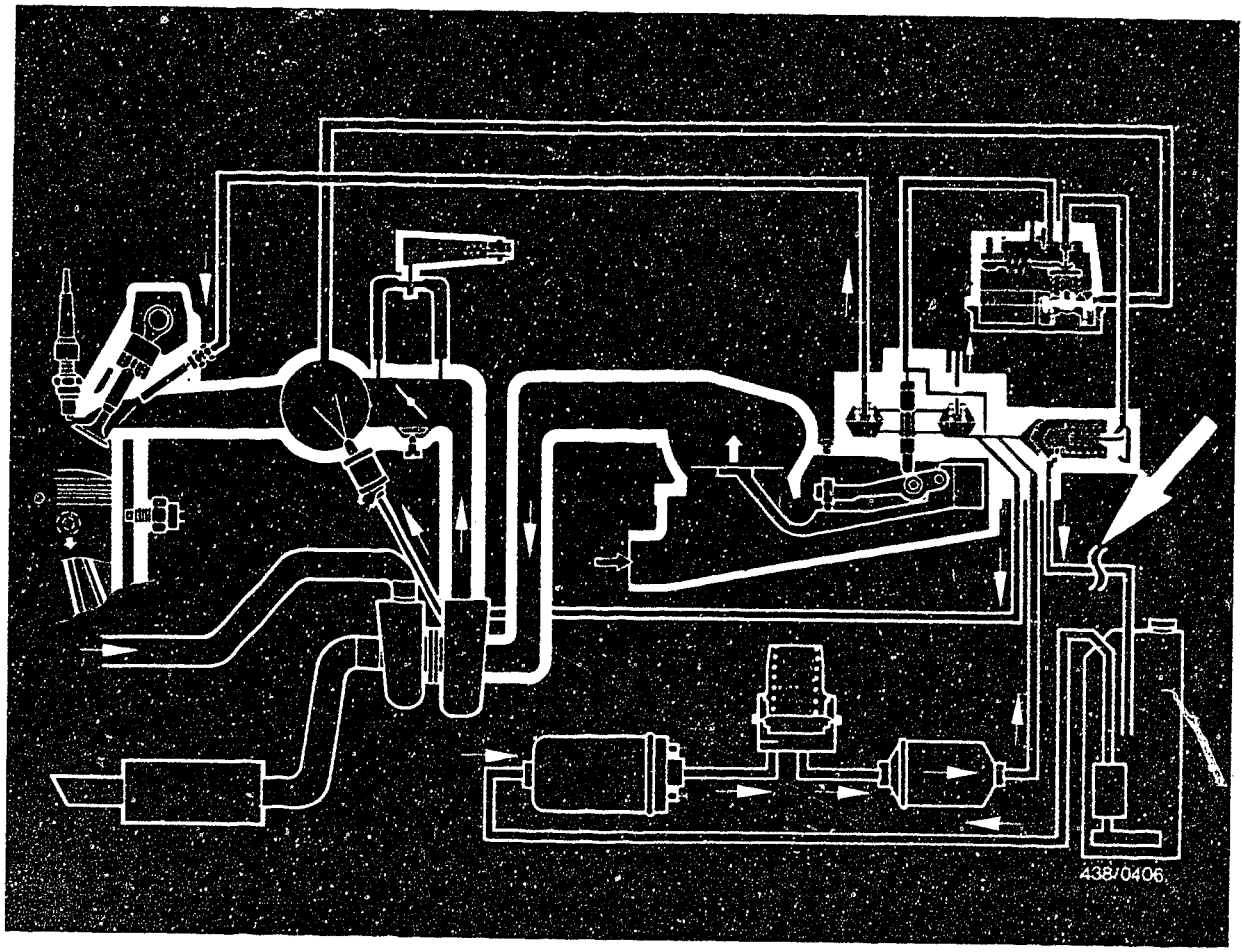
11. Checking the operation of the auxiliary-air device.

- The engine must be cold.
- Disconnect the electric cable plugs from the auxiliary-air device and warm-up regulator.
- Disconnect both air hoses from the auxiliary-air device.

Since the two hose fittings on the auxiliary-air device are located exactly opposite each other, a visual check can now be made to see if the blocking plate is partially open.
It will be easier to look through the auxiliary-air device with the aid of a flashlight and a mirror, as shown in the illustration.



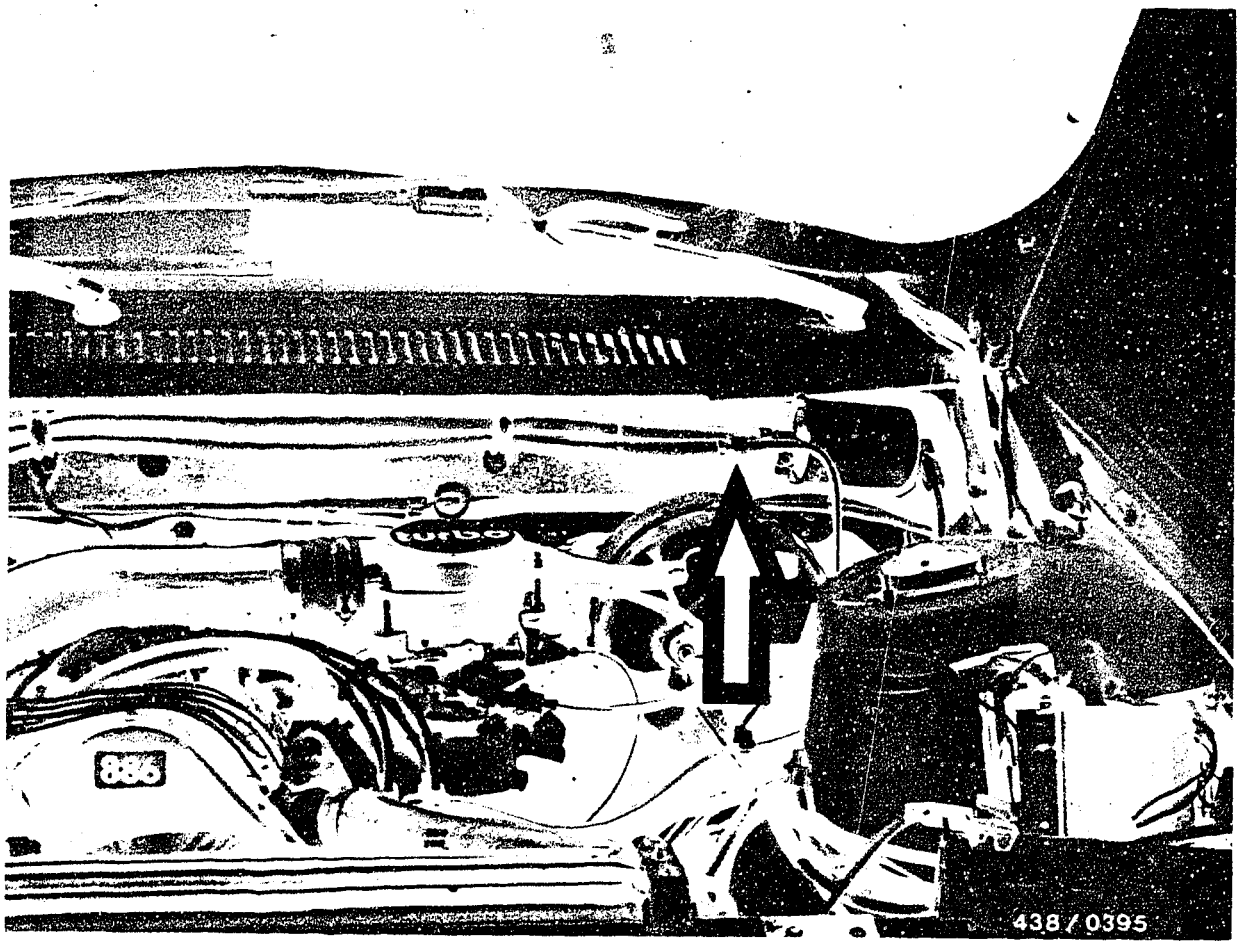
If an opening is not visible with the engine cold, replace the auxiliary-air device.
Fit the electric cable plug on the auxiliary-air device.
By bridging the electrical safety circuit, supply power to the auxiliary-air device.
After a maximum of 10 minutes, the opening in the auxiliary-air device must be completely closed by the blocking plate.
If the blocking plate does not close, check the power supply (open circuit, voltage drop).
The minimum voltage at the connector is 11.5 V with the engine switched off.
If these items are in proper condition, check the heating coil in the auxiliary-air device with an ohmmeter for an open circuit.
Replace a defective auxiliary-air device.



12. Checking the operation of the electric fuel pump.

12.1 Requirement

Conclusive information on the operation of the electric fuel pump can only be given by a measurement of fuel delivery under pressure, i.e. under primary (system) pressure. This measurement must therefore be made at the return line leading to the fuel tank (arrow).



12.2 Measuring point

A suitable measuring point for checking the fuel delivery is the screwed joint (arrowed) in the fuel return line to the fuel tank. Unscrew the screw joint and hold the hose (coming from the fuel distributor) in a graduate (approx. 1.5 litres capacity) in order to make the measurement.

12.3 Checking:

Pull off the plug from the warm-up regulator and the auxiliary-air device.
Switch on the electric fuel pump for 30 seconds by bridging the safety circuit and determine the amount of fuel delivered in a graduate.

12.4 Test specification:

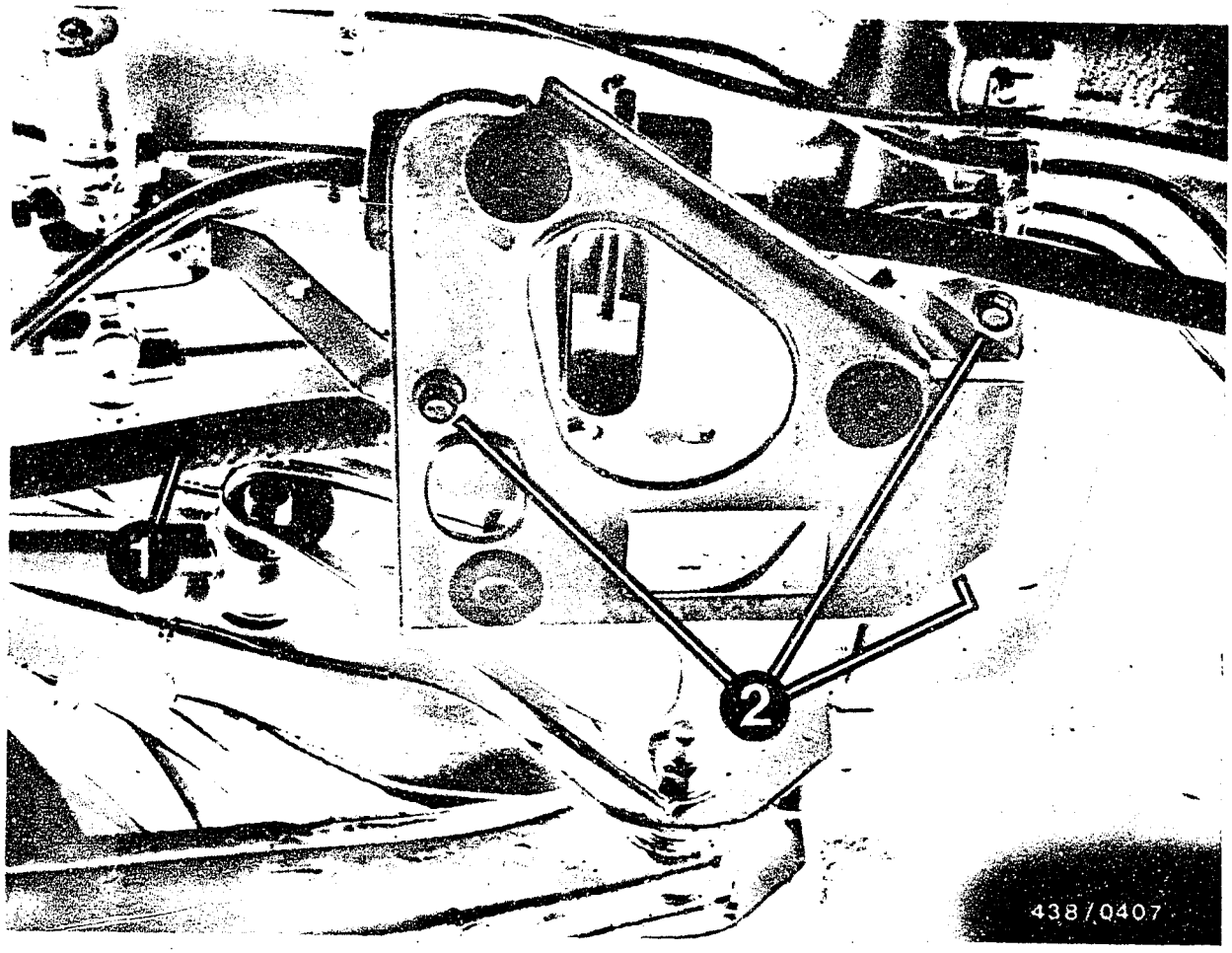
Fuel delivery: at least 900 cm^3/30 seconds.

12.5 Possible causes of insufficient fuel delivery:

- Power supply to the electric fuel pump defective, voltage drop. Minimum voltage required at the terminal with pump operating = 11.5 V.
- Fuel filter very dirty.
- Primary pressure too high.
- Pre-supply pump not functioning.

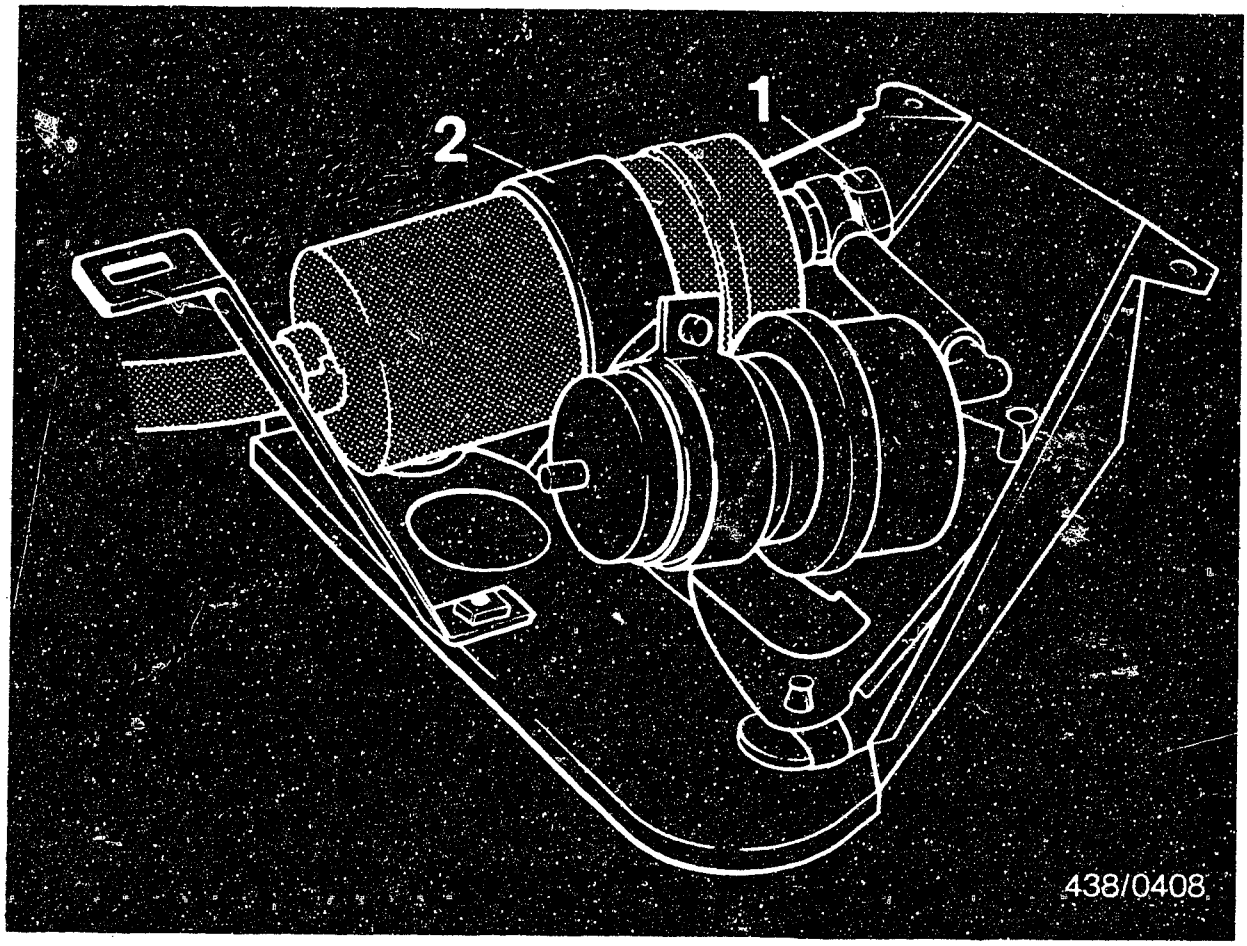
If necessary, carry out noise test with main fuel pump electrically disconnected.
If uncertain, remove hose from the suction fitting of the main electric fuel pump and hold the end in a graduate. Compare the amount of fuel flowing out. More fuel must be supplied if the pre-supply pump is switched on than when it is switched off.

If these items are in proper condition, then the cause of insufficient fuel delivery lies in the electric fuel pump itself. Replace the electric fuel pump.

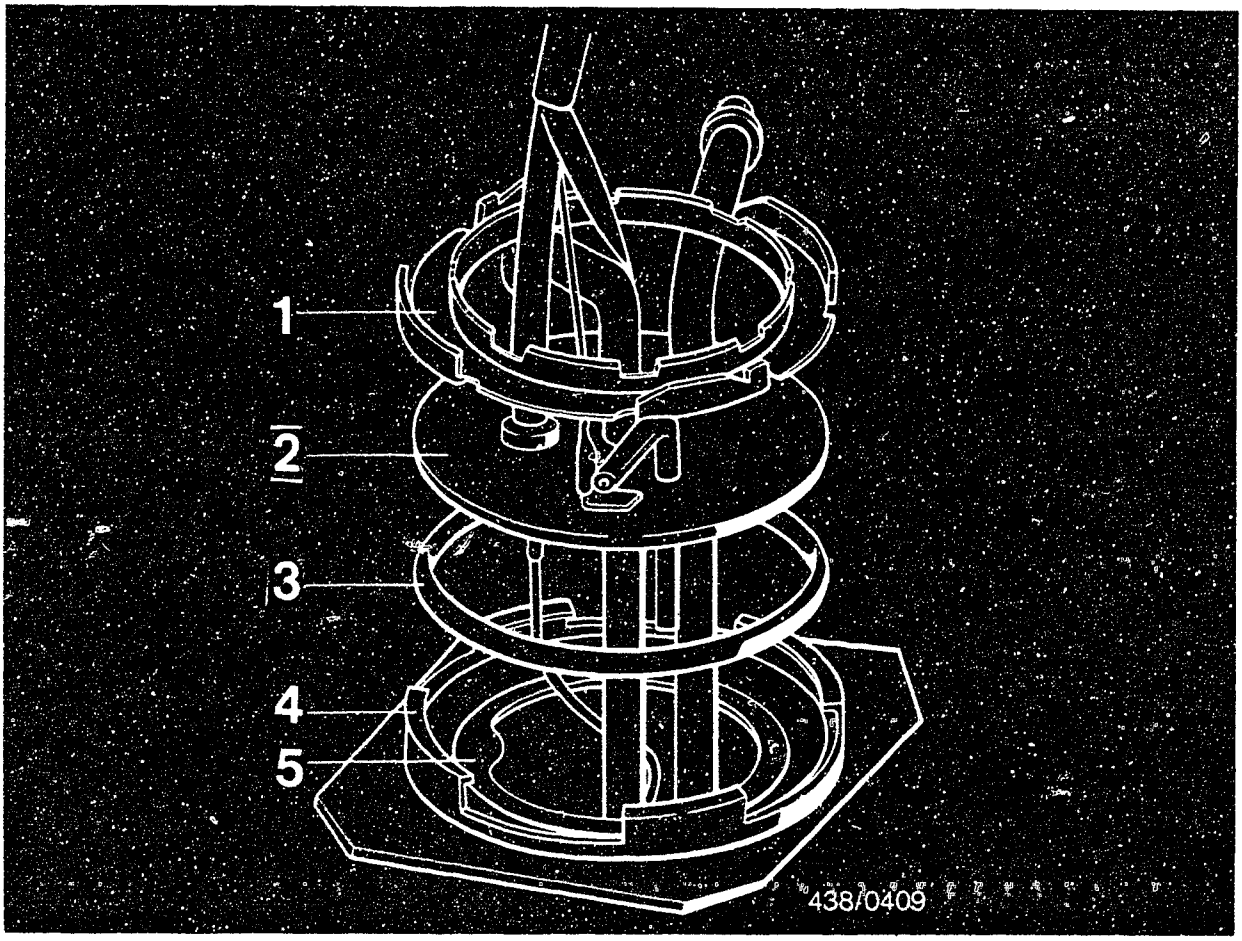


12.6 Removal and installation of electric fuel pump:

Pinch off the fuel intake hose (1) (e.g. using hose clamper W 157 from Matra Co.) so that no fuel can flow from the fuel tank.
Loosen the hose strap and pull the intake hose from the socket of the electric fuel pump.
Remove the complete bracket by unscrewing the 3 fastening screws (2, one screw not visible in picture) and hold it somewhat lower down using connected storage lines. Take care not to damage the lines which are still connected.



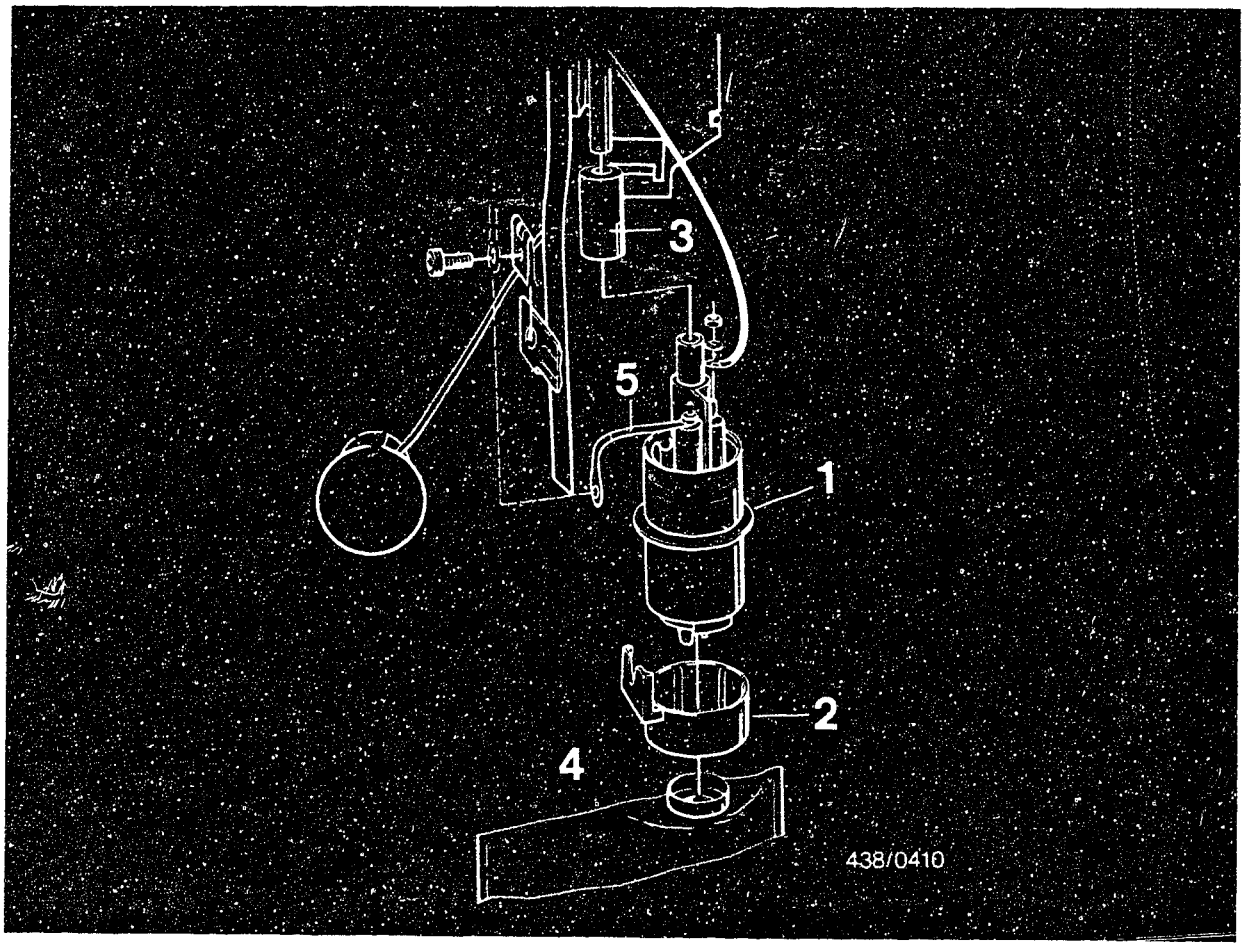
Unscrew tubing (1) from the electric fuel pump.
Loosen the clamp (2) and remove the electric fuel pump.
Installation takes place in reverse order and new sealing rings must be used for the tubing.
Test all the connections for leaks while the pump is operating.



1 = Fastening ring
2 = Fastening flange
3 = Sealing ring
4 = Installation opening in fuel tank
5 = Fixing element

12.7 Removal and installation of the pre-supply pump:

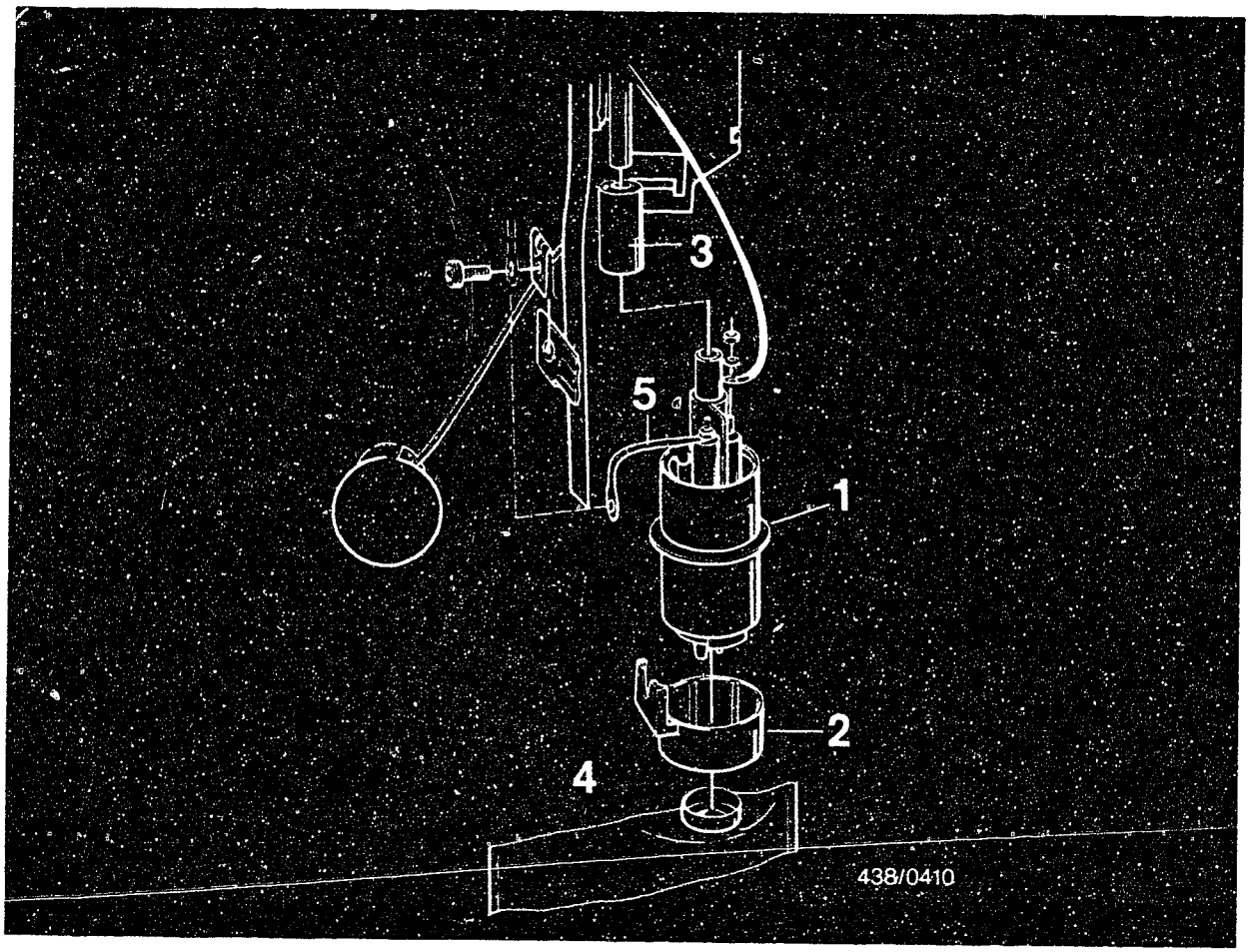
The pre-supply pump is mounted together with the fuel gauge sensor to form one unit. To reach the sensor, remove the luggage compartment mat and the small cover held down by two screws. When removing the sensor clean the immediate area around it. Undo the fastening ring by turning to the left and carefully remove the sensor from the fuel tank. When changing the pre-supply pump at the removed sensor, please observe the following instructions.



Volvo previously used two different makes of pre-supply pump, the VDO and the AC.
From the end of 1980, Volvo will only use the AC pump as a replacement part. If the pre-supply pump becomes defective, the VDO pump should, if necessary, be replaced by a AC pump. The following parts are required for changing over (to be supplied by the Volvo representative together with the pre-supply pump):

1 = Pre-supply pump
2 = Bracket
3 = Hose connection (if required)
4 = Intake filter (if required)
5 = Earth strap

When changing over, the earth strap should be directly connected to the negative terminal of the AC pump.



In contrast to the VDO pump, the AC pump is not provided with interference suppression. Therefore, after installation of the AC pump, an interference-suppression resistor, Volvo part number 1235 204-3, must be installed. This is placed outside the fuel tank in the positive lead (in series).

A new fuel gauge sensor will be available from Volvo from the beginning of 1981 (Volvo part number 1258853-9) which has been specially prepared for the AC pump and provided with interference suppression.

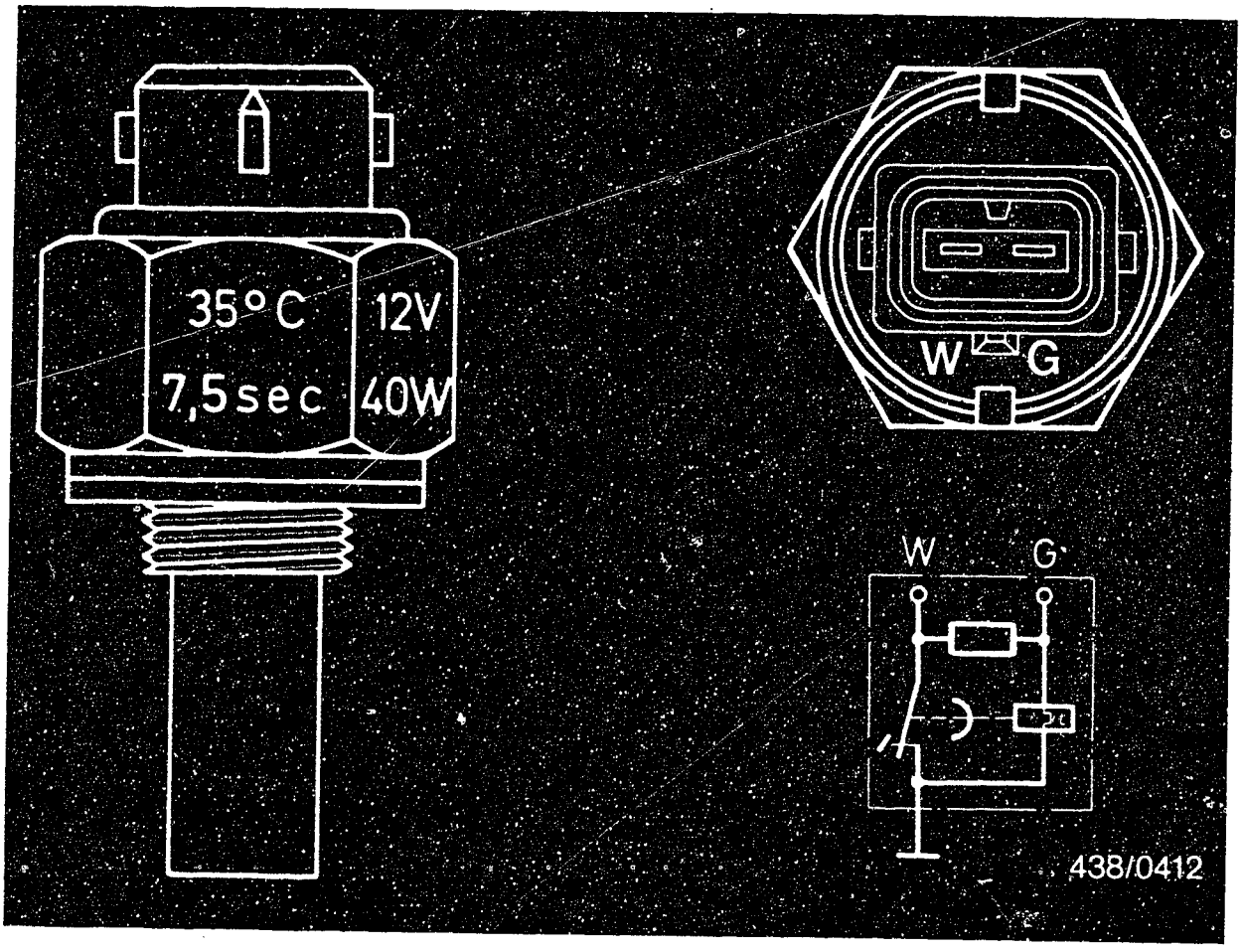
When installing the sensor, use new sealing rings if necessary and make sure that the fastening flange is in the right position with respect to the fixing element in the installation opening.

13. Checking the cold-start system (thermo-time switch, cold-start valve).

13.1 Thermo-time switch:

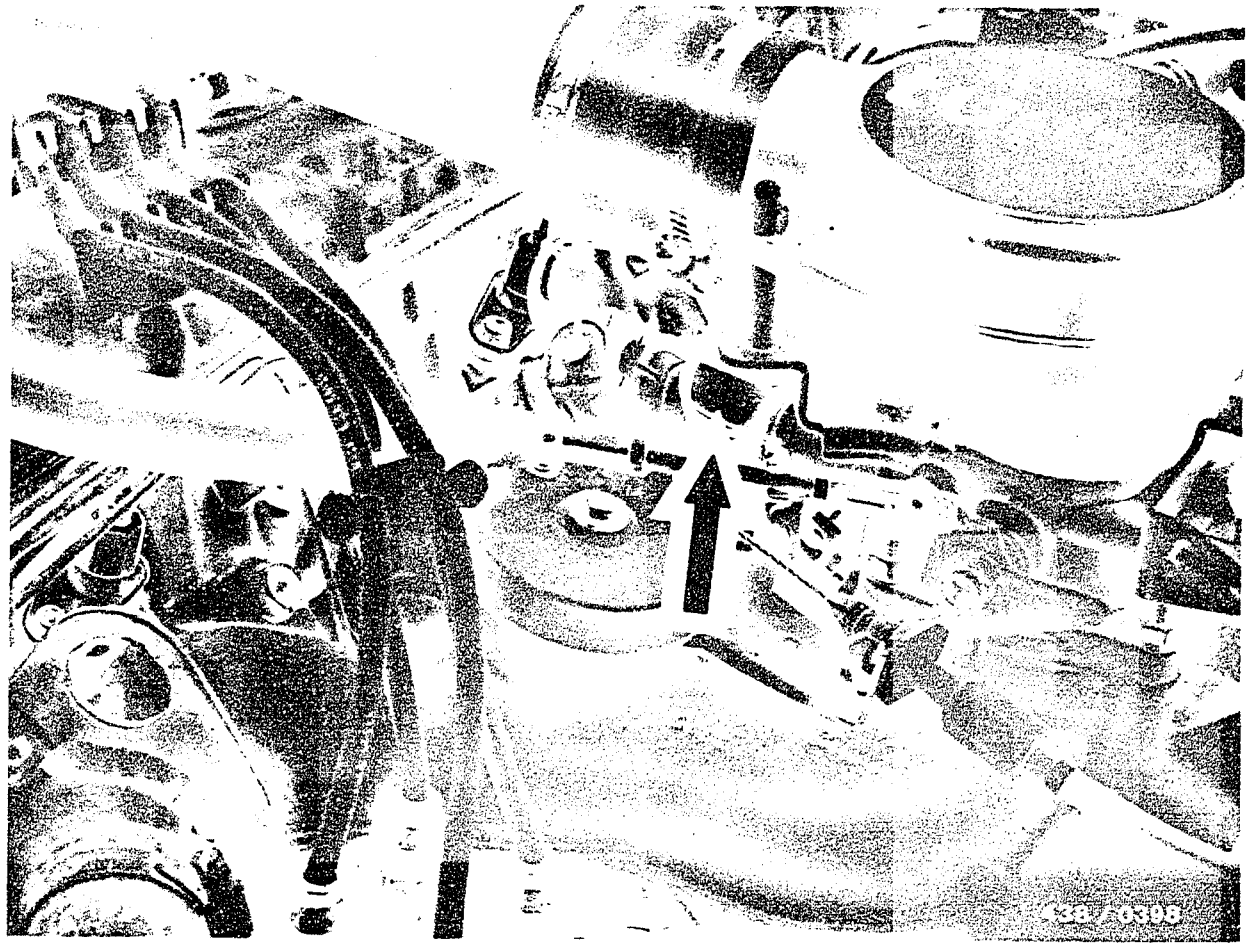
Remove the thermo-time switch for testing.
It is screwed into the flange of the air intake tube of cylinder 4 at the cylinder head.

Caution:
Remove if possible when the engine is cold since some coolant escapes. The amount of coolant escaping would be considerably greater if the engine was warm.



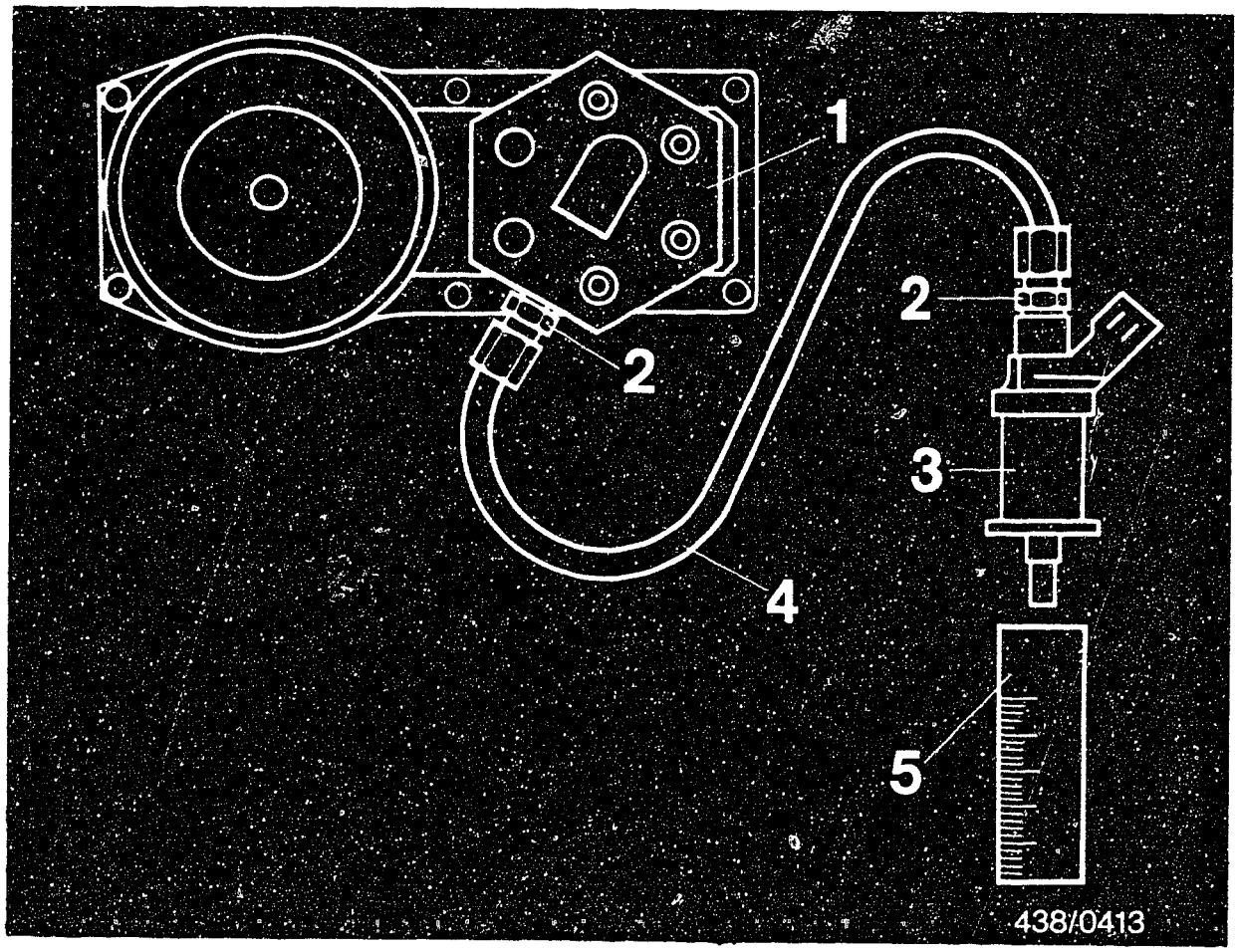
The thermo-time switch used in the Volvo B 21 ET has a switching temperature of 35°C and a switching time at -20°C of 7.5 seconds. Both of these values are stamped into the hexagonal section of the thermo-time switch. The removed thermo-time switch is tested using the ohmmeter in accordance with the specifications given below.
The temperatures for the thermo-time switch can easily be obtained with water. Cooling takes place in a freezer chest.

At a temperature below °C	above °C	Resistance measurement between Term. "G" and "ground" (housing)	between Term. "W" and "ground" (housing)	between Term. "G" and Term. "W"
+30		25...40Ω	0Ω	25...40Ω
	+40	50...80Ω	100...160Ω	50...80Ω



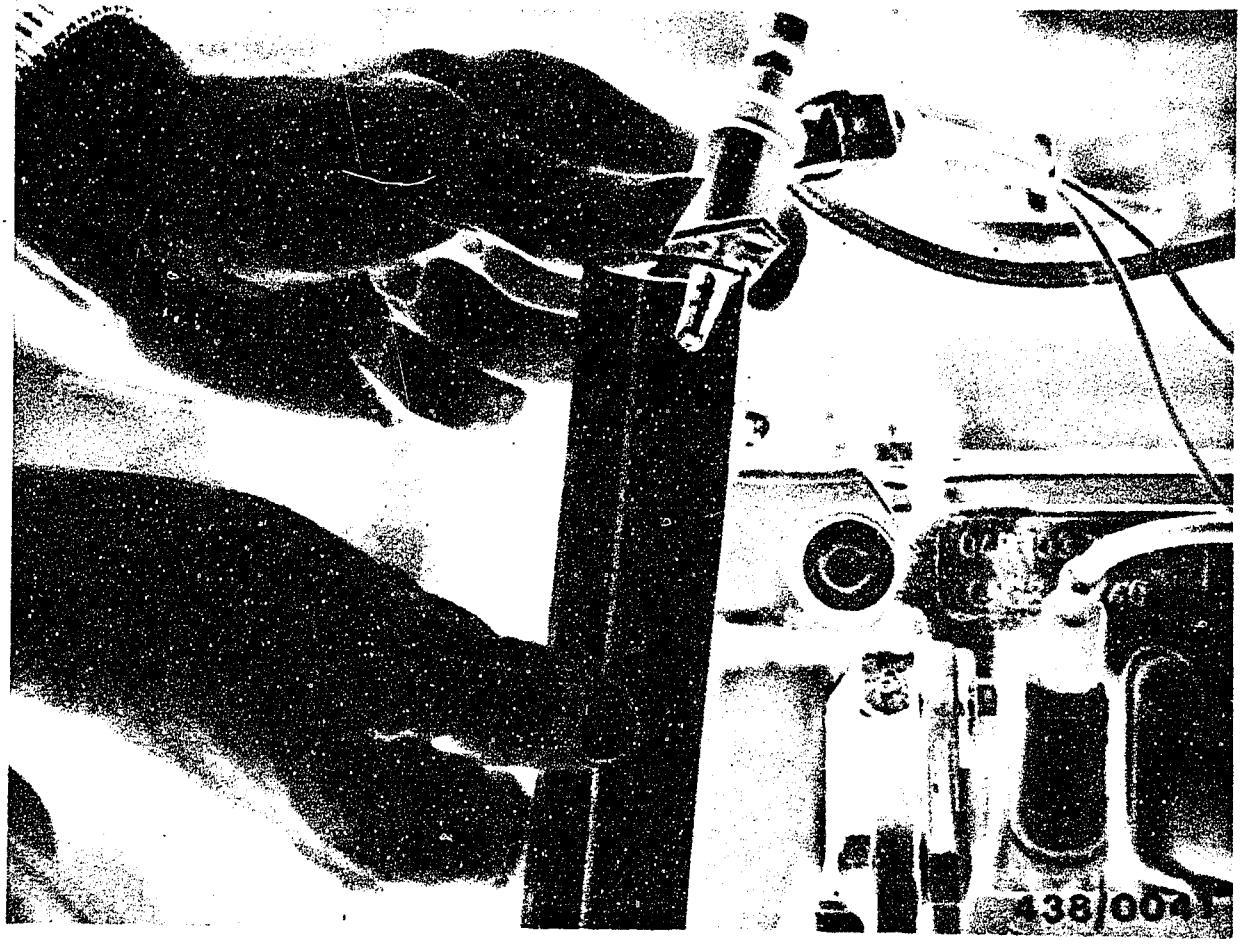
13.2 Start valve

Remove the start valve for testing. It is mounted in the throttle-valve housing underneath the air supply tube. During checking, the fuel line should remain connected. Since this is not possible due to the steel fuel lines, the start valve can be directly connected to the fuel distributor as follows.



1 = Fuel distributor
2 = Double threaded connectors M 8x1/M 12x1.5 (commercially available)
3 = Start valve
4 = Hose from KDJE-P 100 (previously KDEP 1034)
5 = Graduate

Unscrew the fuel line to the start valve at the fuel distributor. Connect the start valve, using two commercially available double threaded connectors M 8x1/M 12x1.5, and one of the two hoses of the pressure tester KDJE-P 100 (previously KDEP 1034) directly to the fuel distributor.



Connect the start valve directly to earth and to terminal 15 (e.g. at the ignition coil) using connecting cable KDJE 7450/70.

Important note:
During this test do not let the connecting cable touch B+.
Danger of fire due to sparking!

Hold the start valve in a suitable container (e.g. graduate).
Switch on the electric fuel pump by bridging the safety circuit.

Switch on the ignition (max. 30 seconds). The start valve must now open and spray fuel.

Switch off the ignition, remove the electric connecting cable and dry the nozzle of the start valve.
The safety circuit remains bridged so that the primary pressure is supplied to the start valve.
No droplets of fuel must drip from the nozzle of the start valve during the next minute. Even if shaken and knocked, the start valve must not leak.
Then switch the electric fuel pump off again.
Replace the start valve if it does not open or if it leaks.

If a leaky start valve or a defective thermo-time switch has been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.
Idle-speed adjustment is described on Coordinates F 12.

14. Checking the control pressures

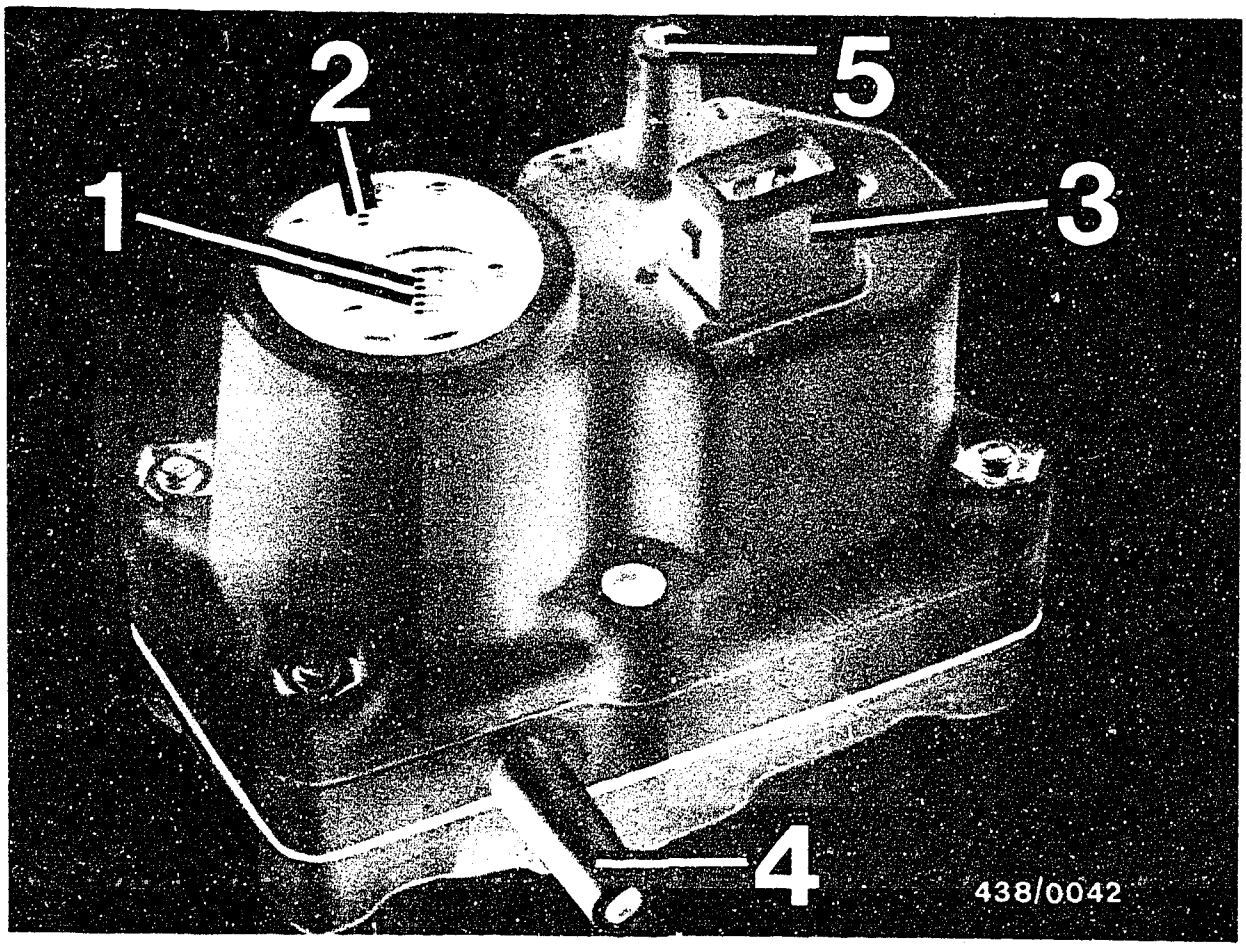
14.1 Preliminary remarks:

The control pressures tested in the following are in each case governed by the warm-up regulator.
If the test results are incorrect, however, this may also be due to faults which have nothing to do with the warm-up regulator.

These possible faults are:

- No or too low a voltage at the electric connector.
- Fuel return from the warm-up regulator blocked or constricted.
- Too high a fuel delivery for the control-pressure circuit.

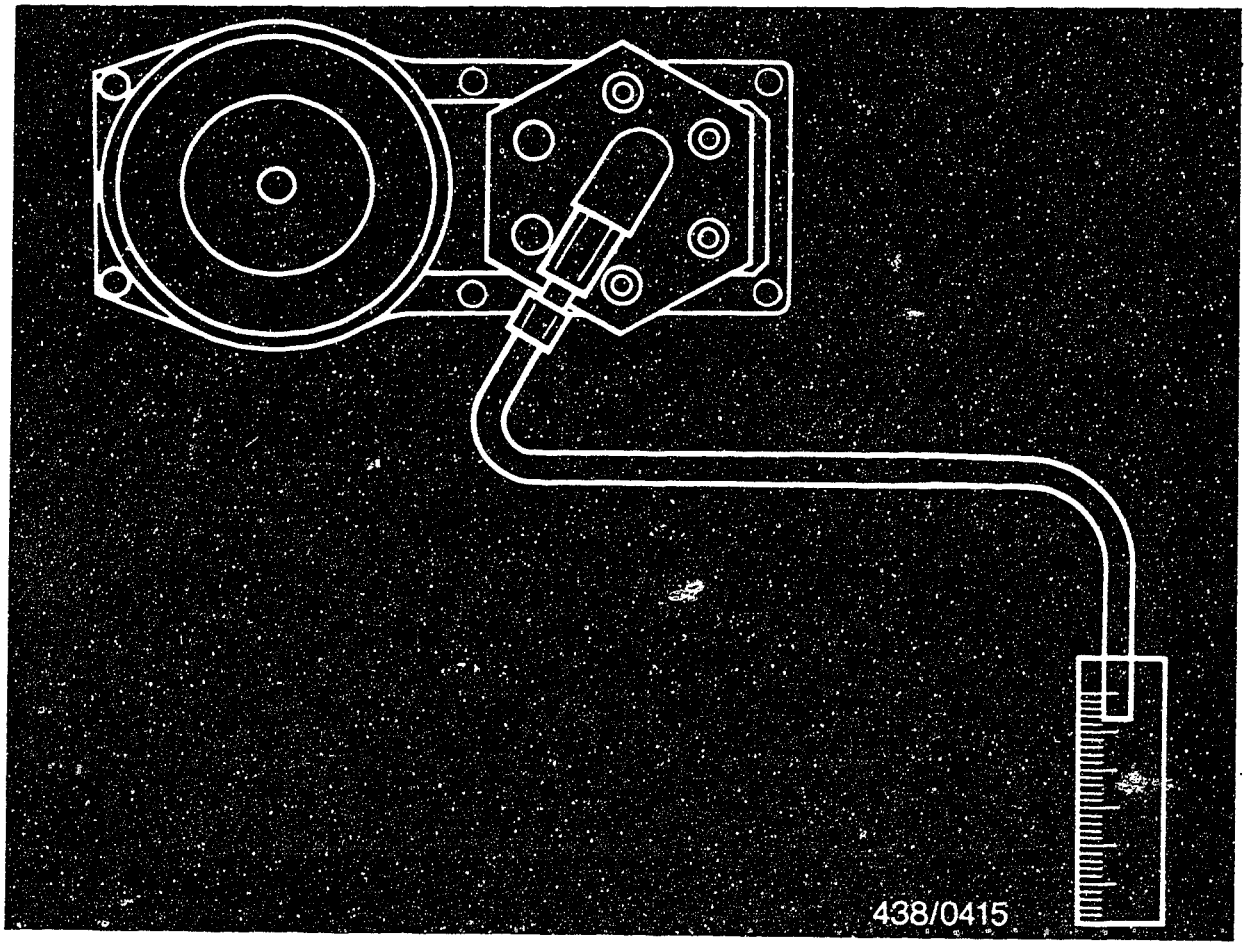
The testing of this control-pressure delivery is described as an additional test step at the beginning of the control pressure tests. Nominal value = 160...240 cm^3/min.
Reference is made to the other possible causes of trouble in the respective test step.



1 = Intake port
2 = Return port
3 = Electrical connection
4 = Intake manifold pressure connection (to throttle valve)
5 = Connection to the atmosphere (connection between air-flow sensor and throttle valve)

14.2 Design of warm-up regulator:

The warm-up regulator is a design for charge-air pressure controlled full-load enrichment.
The function of this warm-up regulator is in principle the same as that of the standard design for intake-manifold pressure controlled full-load enrichment. The enrichment (reduction in control pressure) does not take place during induction but when there is charge-air pressure (gauge pressure) in the intake manifold.



14.3 Checking the fuel delivery for the control-pressure circuit:

Test requirement: the electric fuel pump is operating properly.

Unscrew the control-pressure line (to the warm-up regulator) from the fuel distributor and screw connecting piece (thread M 8x1/M 12x1.5) from connecting-parts set KDJE-P 100/10 on to the control-pressure port.

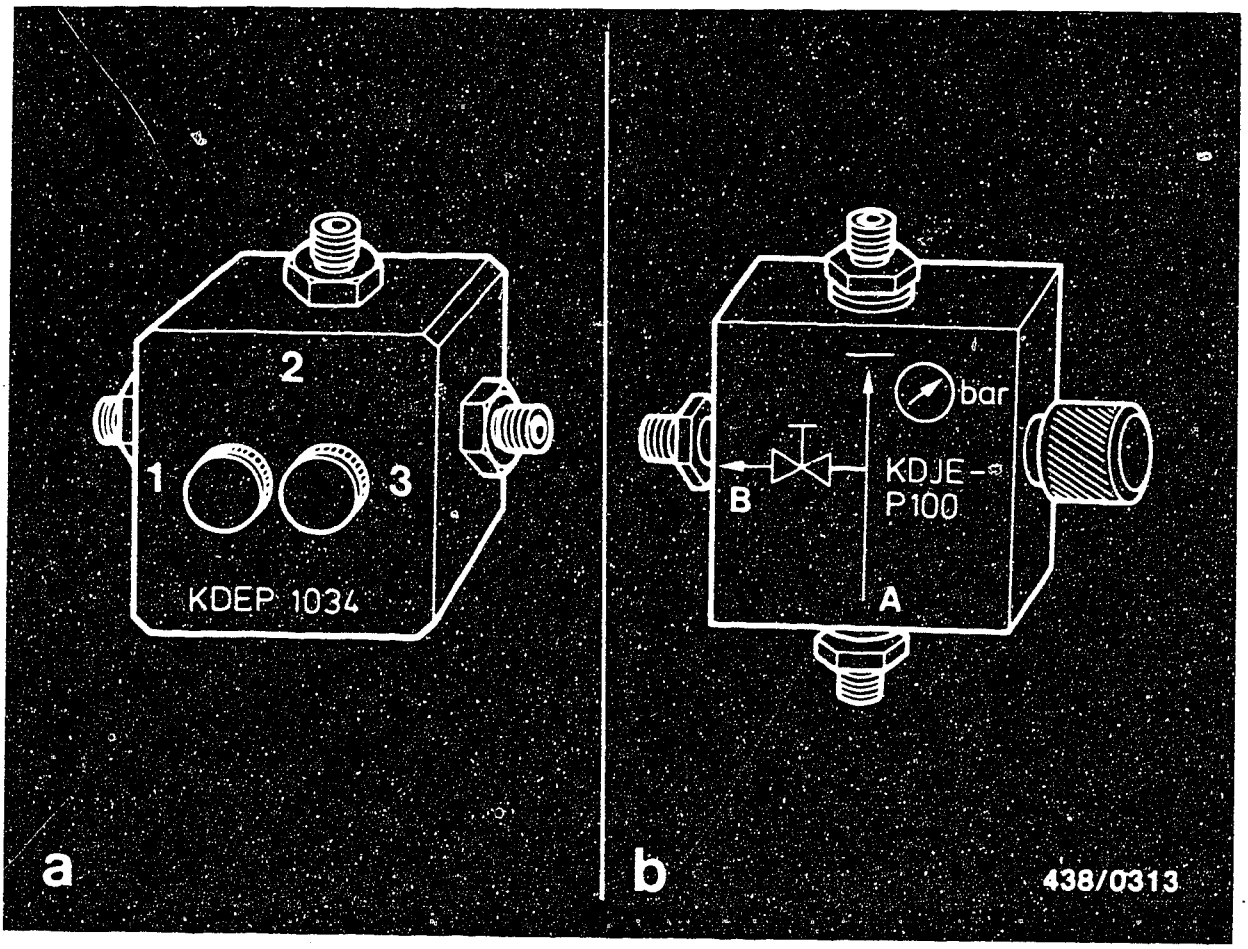
Connect one of the two hoses of the pressure tester KDJE-P 100 (previously KDEP 1034) to the control-pressure port of the fuel distributor (thread M 12x1.5) and hold hose in graduate (approx. 0.5 litre capactiy).

Switch on the electric fuel pump for 1 minute by bridging the safety circuit.
Measure delivery.

Test specification: 160...240 cm^3/min.

If the measured value is outside tolerance, the fault is in the fuel distributor.

Replace the fuel distributor.



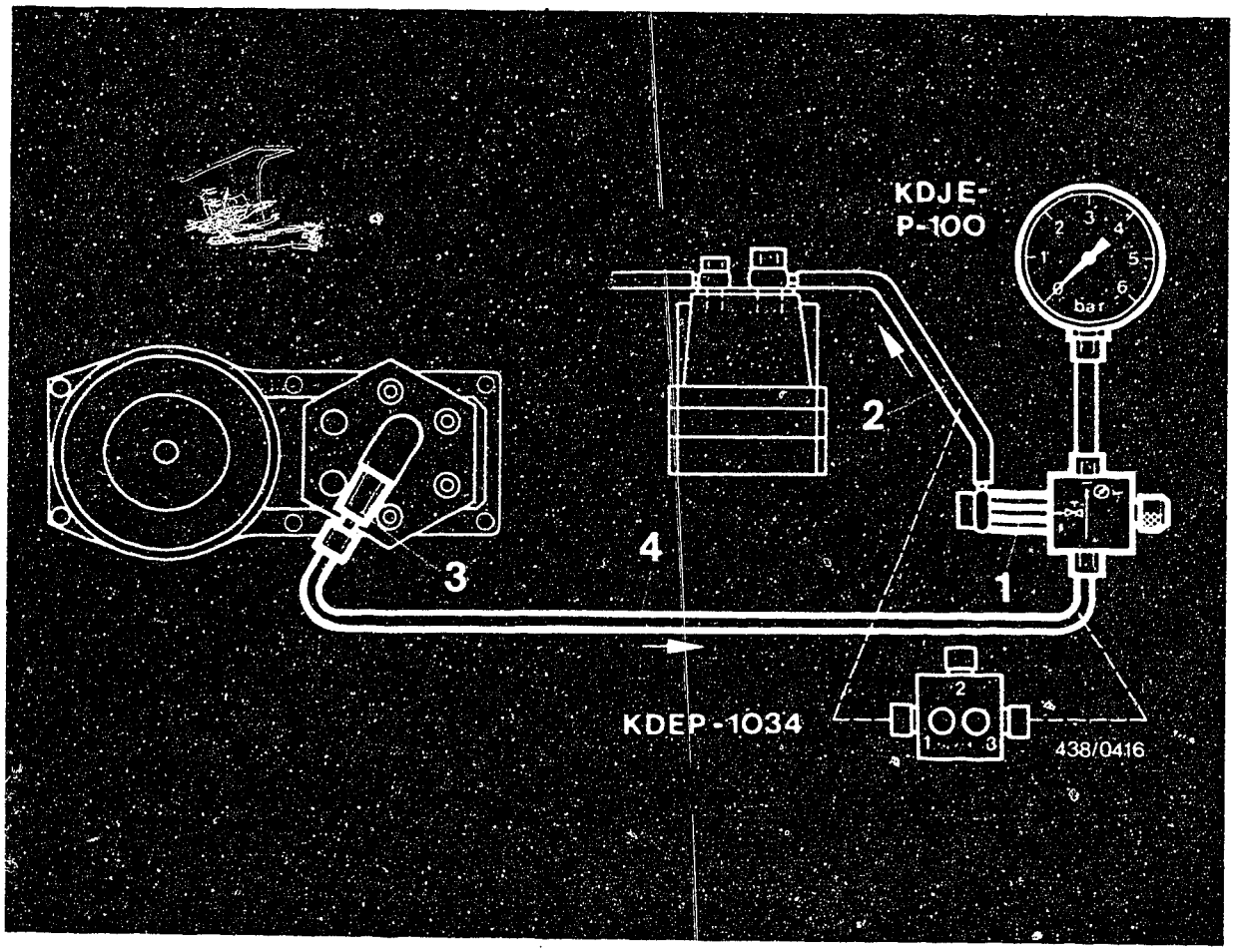
14.4 Mounting the pressure tester KDJE-P100 (formerly KDEP 1034):

The pressure tester DEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a).

Since the end of 1979 the pressure tester KDJE-P100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional control valve are identified by symbols:

A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.



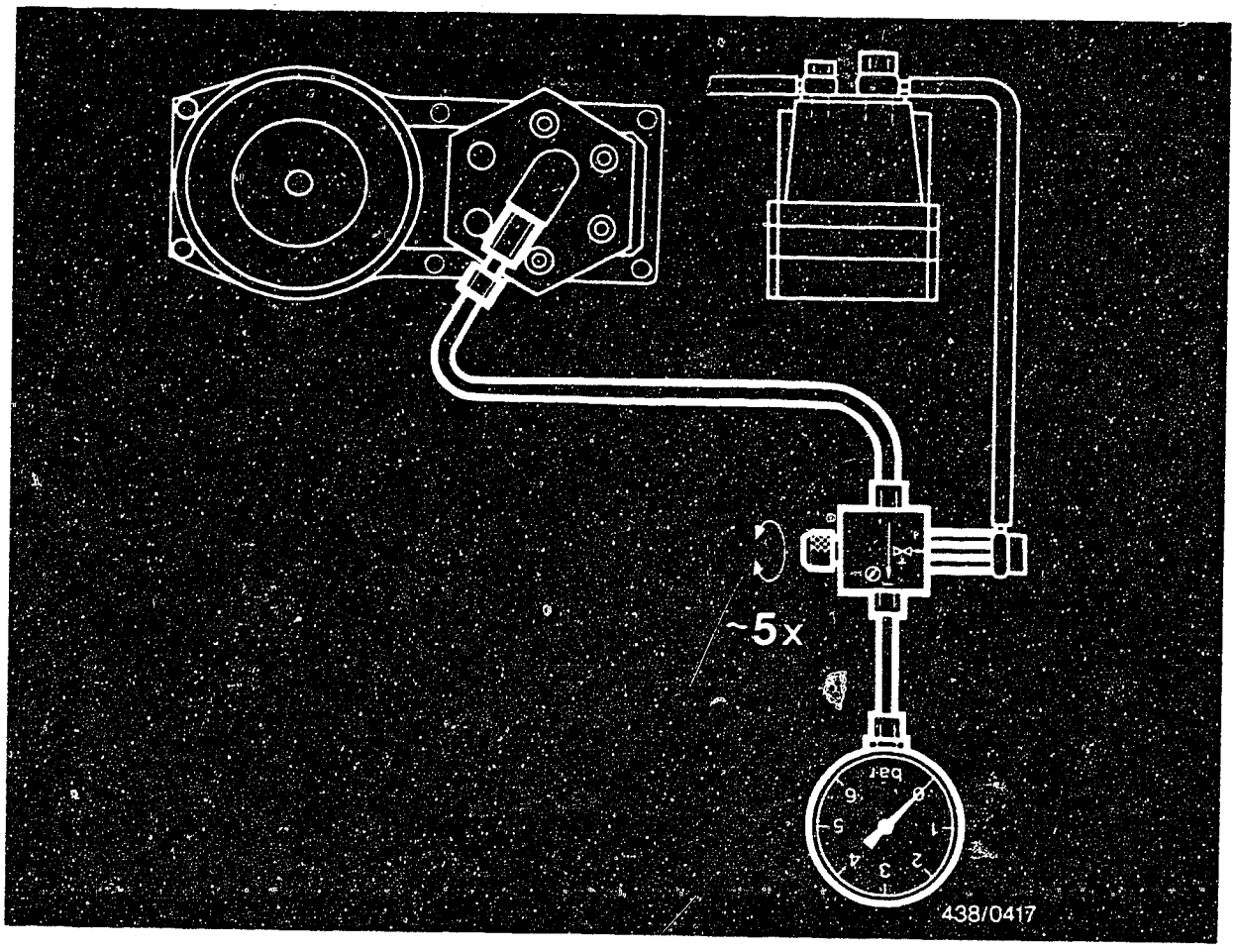
The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.

Fitting is carried out using connecting-parts set KDJE-P 100/10.

Screw the adapter from the connecting parts set with a sealing ring onto connection B or 1 of the directional-control valve (1).

Unscrew the control-pressure line (to the warm-up regulator) from the fuel distributor and connect it to the adapter (2).

Screw the connecting part of the connecting-parts set to the control-pressure connection of the fuel distributor (3) and connect it to connection A or 3 of the directional-control valve via a hose (4).



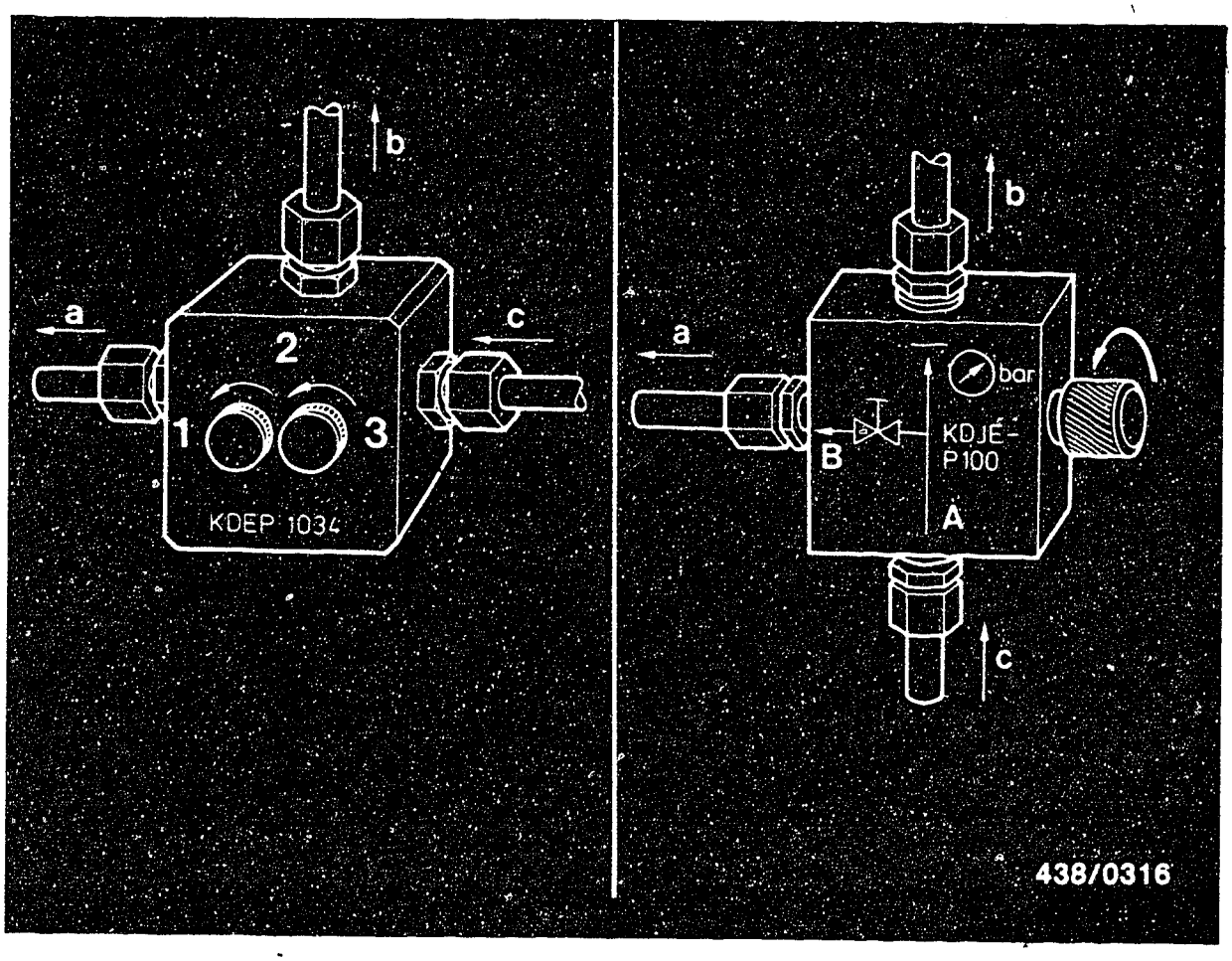
14.5 Bleeding the pressure tester:

Disconnect the electric plug from the warm-up regulator and auxiliary-air device.

Let the pressure gauge hang down (hose fully extended). Switch on the electric fuel pump by bridging the electrical safety circuit:

Open and close the valve screw of the directional-control valve (in the case of KDEP 1034, valve screw 1) in a 10-second rhythm about 5 times. Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood).

Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

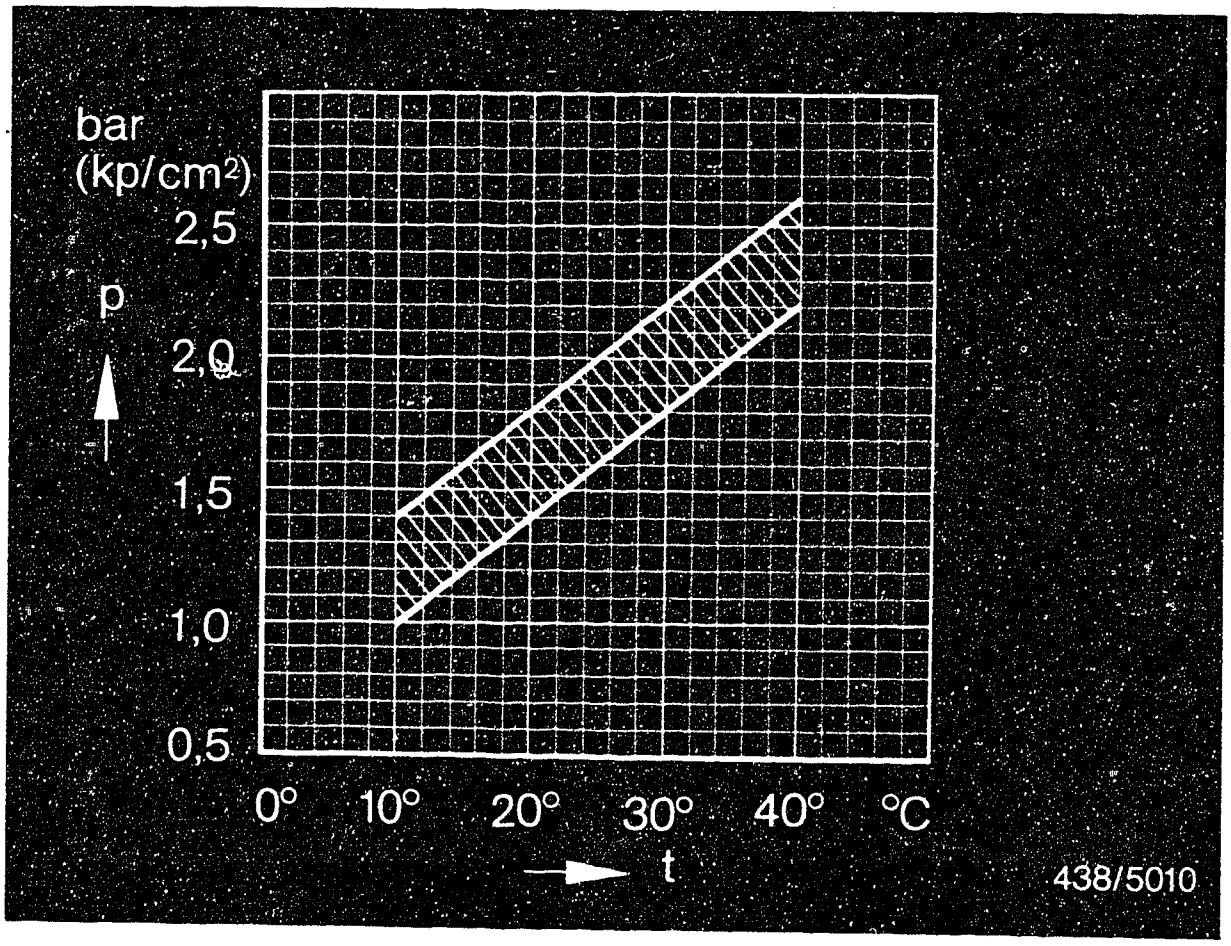
14.6 Testing the "cold" control pressure

The test is performed with the engine switched off. The engine must be cold. For this purpose, the engine should have been switched off for several hours, preferably overnight.

Pull off the plug from the warm-up regulator.

Open the valve screw of the directional-control valve (both screws in the case of KDEP 1034).

Switch on the electric fuel pump by bridging the electrical safety circuit.



p = Control pressure (gauge pressure)
t = Ambient temperature (°C)

Warm-up regulator Part No.: 0 438 140 082

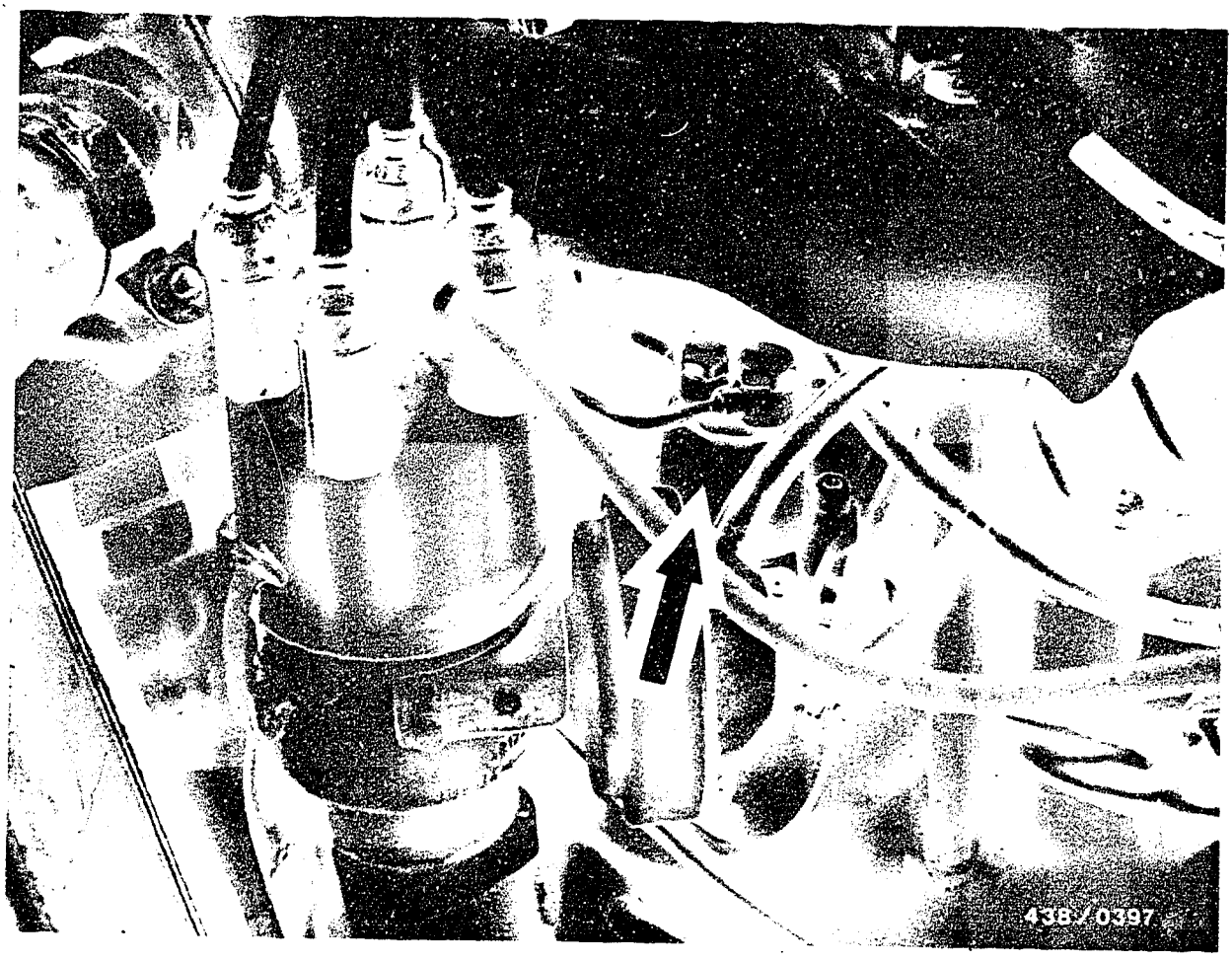
Calculate the nominal control pressure in accordance with the ambient temperatures in the graph.
Example:
Ambient temperature = 20°C
Nominal control pressure = 1.4...1.8 bar gauge pressure

If the measured "cold" control pressure differs from the nominal value, this may be due to one of the following faults:

- Fuel delivery for the control-pressure circuit too low or too high. Test fuel delivery.
Nominal value = 160...240 cm^3/min.

- Fuel return from the warm-up regulator blocked or constricted (if control pressure too high).
Eliminate constriction.

- Warm-up regulator defective. Replace warm-up regulator.

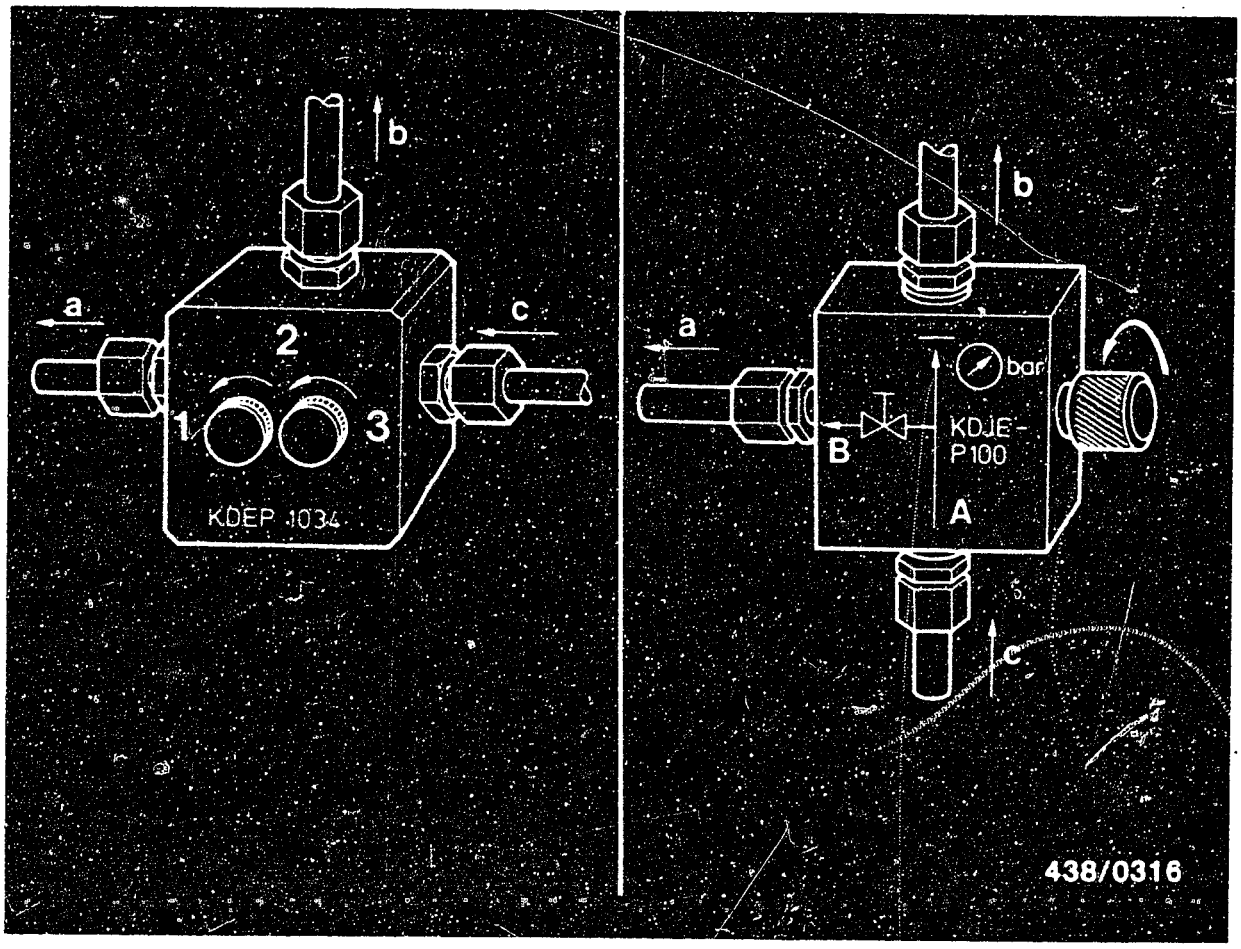


Removal and installation of warm-up regulator:

The warm-up regulator is mounted on a bracket on the engine block beneath the air intake tube of cylinder 2 (arrowed).

Fuel lines must be connected with new sealing rings.

Caution:
After any work has been carried out in the area of the warm-up regulator, make sure that the hose between the intake manifold (to the throttle valve) and the warm-up regulator (lower connection) is correctly and firmly positioned. If this is not so, no charge-air-pressure controlled full-load enrichment takes place.
Absence of full-load enrichment can lead to serious engine damage.



a = to warm-up regulator
b = to pressure gauge
c = from fuel distributor

14.8 Checking the "warm" control pressure:

Warm-up regulator part number: 0 438 140 082
The test is carried out with the engine switched off, once without applying charge-air pressure, once with simulated charge-air pressure.

Test procedure:

Engine temperature not important.
Open the valve screw of the directional-control valve (both screws in the case of KDEP 1034).
Switch on the electric fuel pump by bridging the electrical safety circuit:
Attach the plug to the warm-up regulator.
Control pressure now rises (the warm-up regulator in the process of shutting off) until the "warm" control pressure is reached without charge-air pressure.

Test specification:

"Warm" control pressure
without charge-air pressure: 3.4...3.8 bar (3.5...3.9 kgf/cm²).

If the measured "warm" control pressure differs from the test specification, this may be due to one of the following faults:

If control pressure too high:

- Fuel delivery for the control-pressure circuit too high.
Test fuel delivery.
Nominal value = 160...240 cm^3/min.

- Fuel return from the warm-up regulator blocked or constricted.
Eliminate constriction.

- Warm-up regulator has hydraulic defect.
Replace warm-up regulator.

If control pressure too low:

- Power supply open-circuit.

Eliminate open circuit. Ensure that the plug is contacting properly.

- Battery voltage too low, voltage drop.

Eliminate voltage drop. Minimum voltage at connector: 11.5 V.
If necessary, repeat test with engine running in order to obtain the normal generator voltage of approx. 14 V when the vehicle is in operation.

- Fuel delivery for the control-pressure circuit too low.

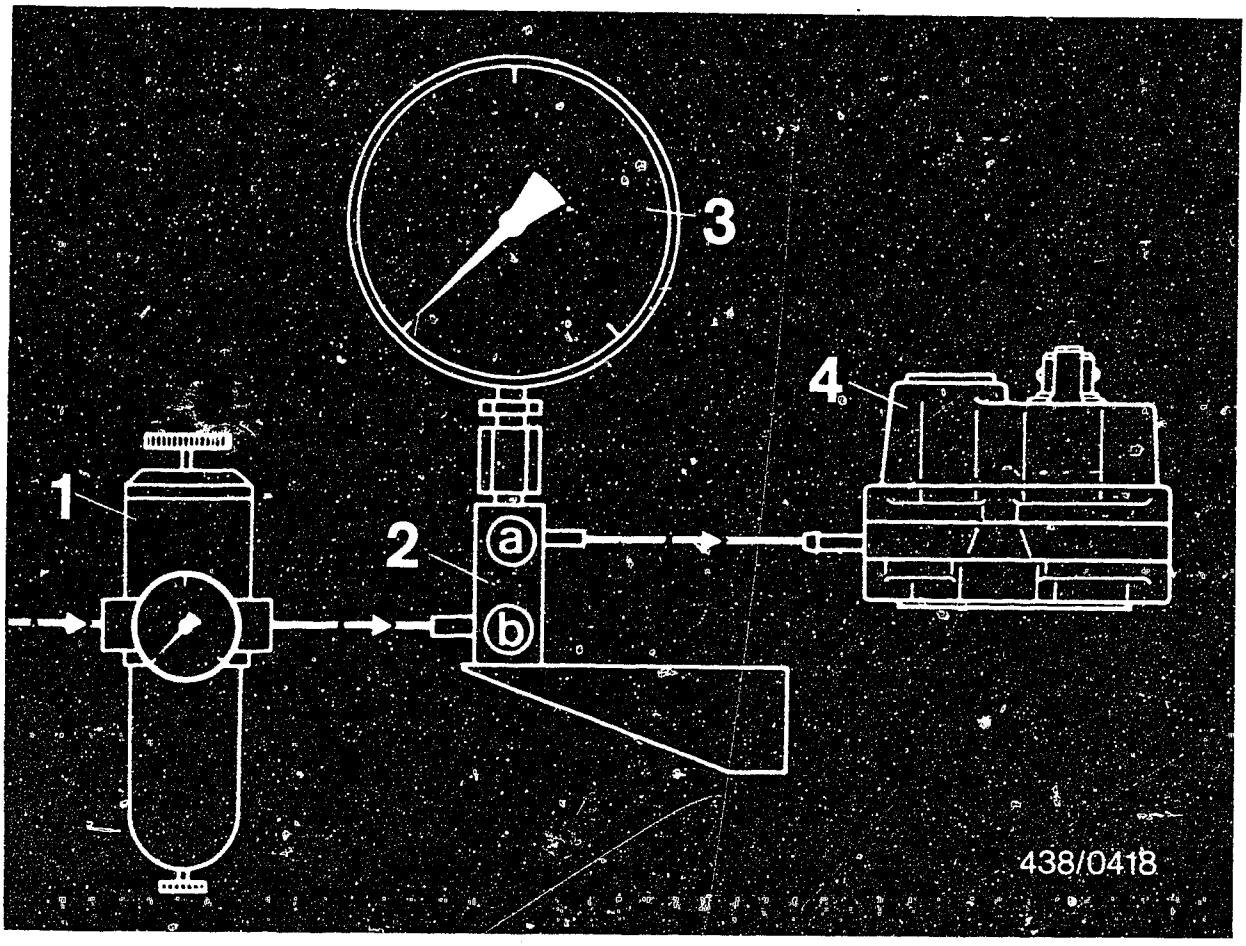
Test fuel delivery.
Nominal value = 160...240 cm^3/min.

- Warm-up regulator defective. Heating coil open-circuit
  Hydraulic defect

- Replace warm-up regulator.

If the warm-up regulator has been replaced or a defect has been eliminated, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.

Idle-speed adjustment is described on Coordinate F12.

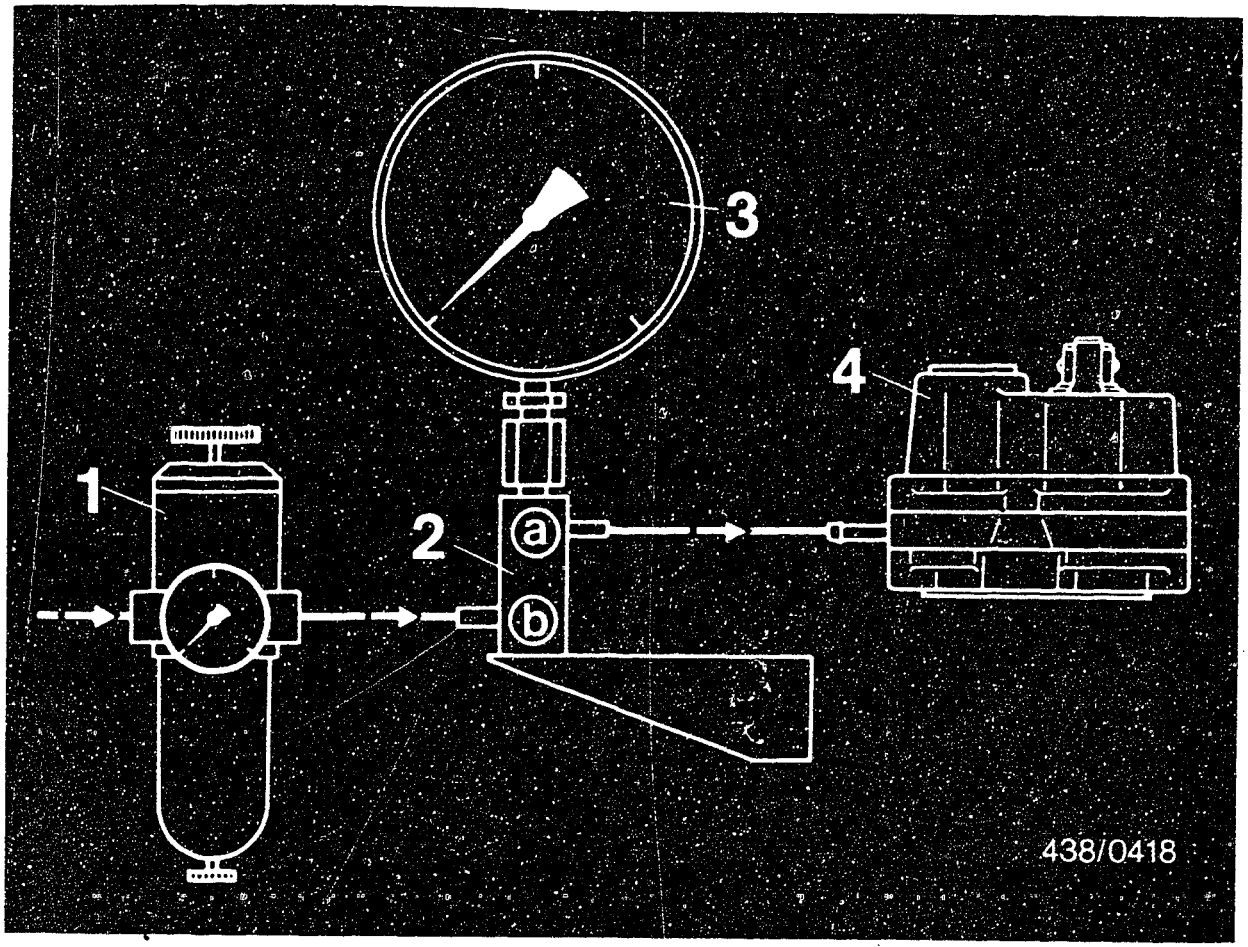


In order to check the full-load control pressure, atmospheric pressure according to the charge-air pressure must be applied to the warm-up regulator.

Pressure is applied via the compressed-air network. The following are required for this:

1 compressed-air reduction valve (1) with pressure gauge 0...4 bar gauge pressure (commercially available, e.g. from Krais and Fritz, Stuttgart, Type No. 104).
1 regulator (2) Bosch 0 688 130 132.
In addition a pressure gauge (3) 0...1.6 bar guage pressure, quality class 1.0 (commercially available, e.g. Wika No. 4184).

Note:
This equipment is often already available in the diesel workshop and is used there for checking the manifold-pressure compensators on diesel fuel-injection pumps.



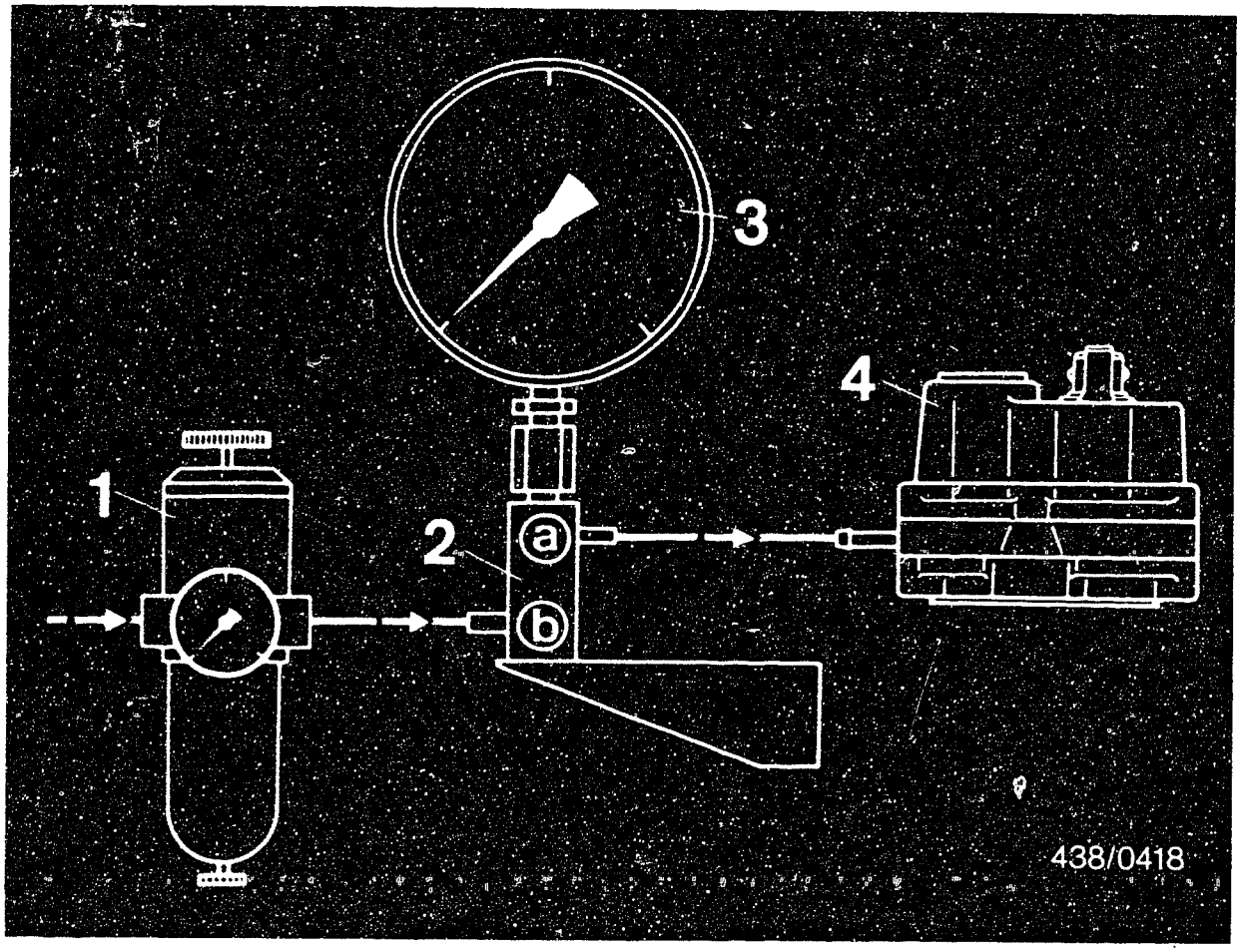
Test procedure for full-load control pressure:

The electric fuel pump remains switched on, the electrical connector on the warm-up regulator remains in position.

Test specification:

Testing with simulated charge-air pressure (gauge pressure):

Charge-air pressure:	Control pressure:
450...550 mbar (340...410 mm Hg)	2.6...3.0 bar (2.7...3.1 kgf/cm²)



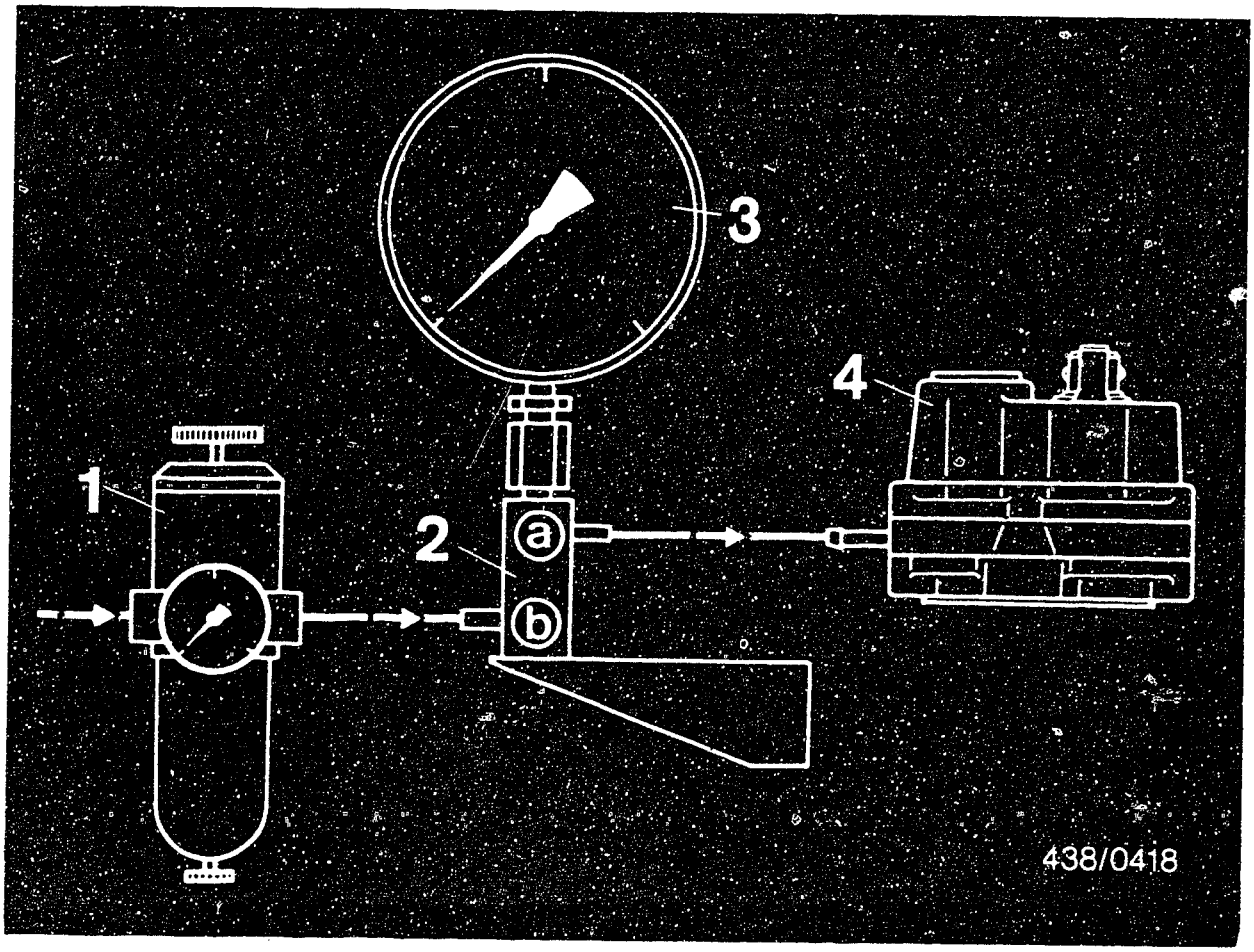
1 = Pressure reducing valve
2 = Regulator
3 = Pressure gauge
4 = Warm-up regulator

Adjust the pressure at the pressure-reducing valve (1) to max. 0.5 bar gauge pressure.

Join the upper connection of the regulator (2) to the warm-up regulator (4).

Open the screw plug of the regulator. Using adjusting screw b, adjust the charge-air pressure according to the test specification. The control pressure must fall to the value "with charge-air pressure".

If this does not happen, replace the warm-up regulator.



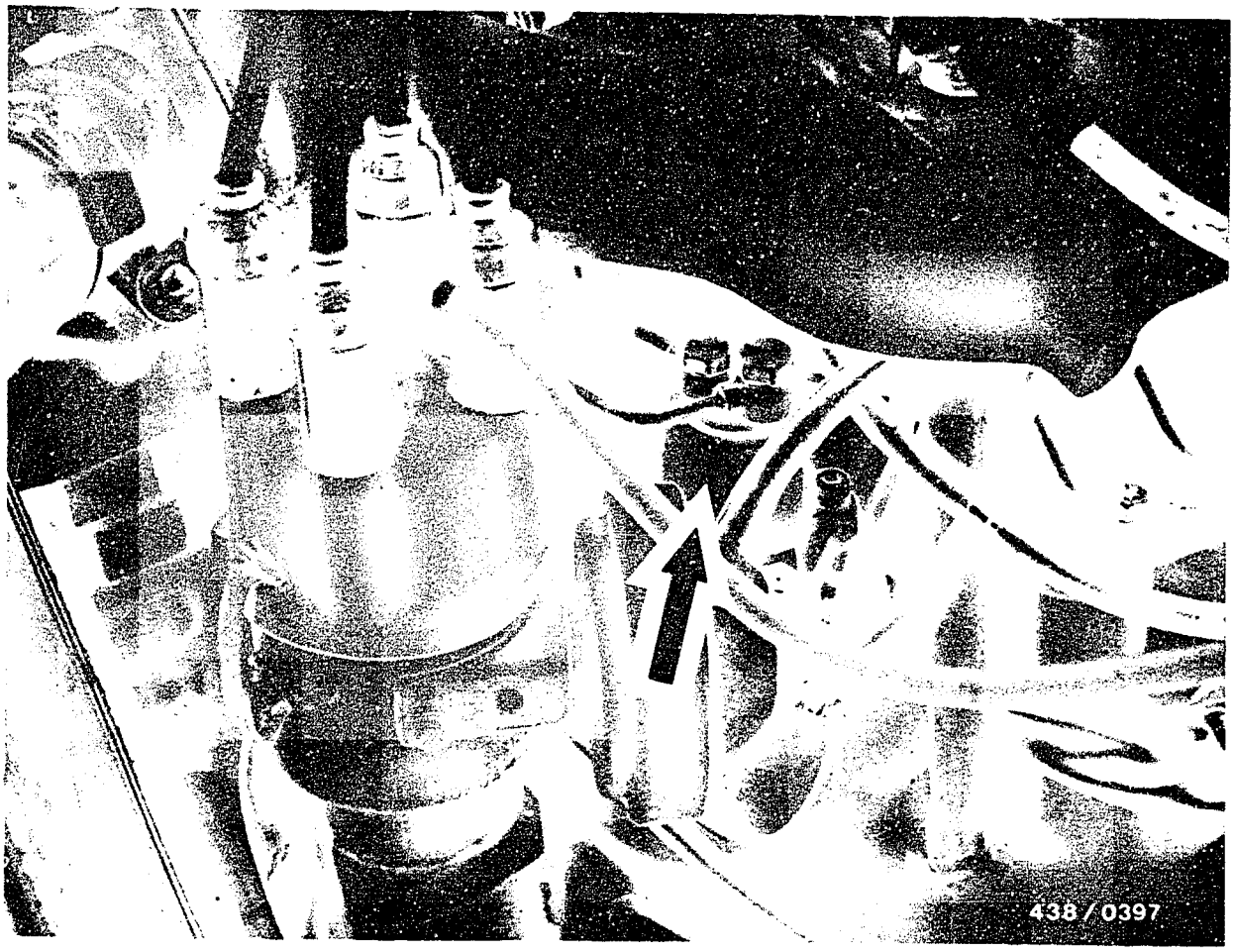
14.9 Testing the full-load diaphragm in the warm-up regulator for leaks:

Test specification:

Test pressure: 600 mbar (450 mm Hg)
Reduction in pressure: max. 66 mbar (50 mm Hg)/15 s

Switch off the electric fuel pump.
Adjust the test pressure according to the test specification by adjusting screw 1.
Close the screw plug and check the reduction in pressure.
If the leakage is too great, replace the warm-up regulator.

Caution: When troubleshooting, always test the full-load control pressure and check the full-load diaphragm for leaks. Engine damage can occur if there is no or very little full-load enrichment.

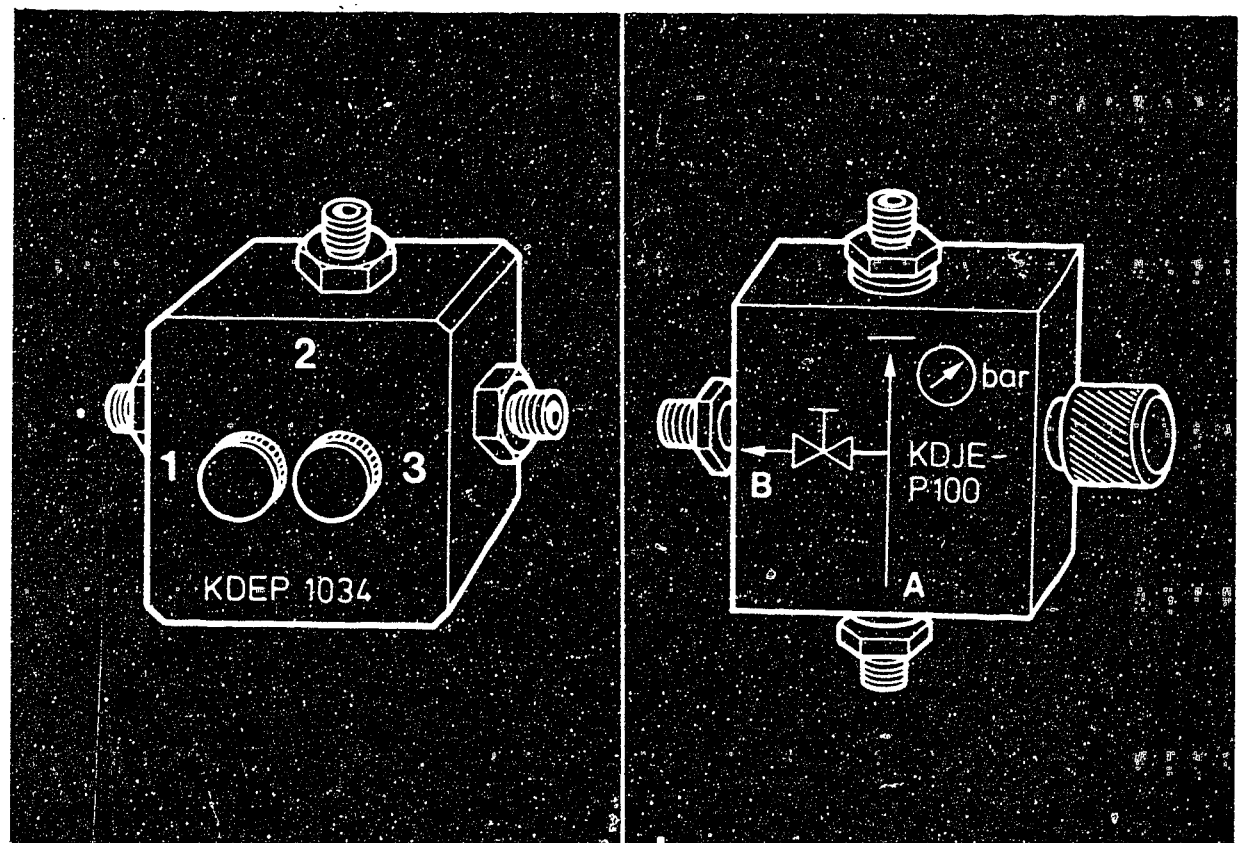


Removal and installation of warm-up regulator:

The warm-up regulator is mounted on a bracket on the engine block beneath the air intake tube of cylinder 2 (arrowed).

Fuel lines must be connected with new sealing rings.

Caution:
After any work has been carried out in the area of the warm-up regulator, make sure that the hose between the intake manifold (after throttle valve) and the warm-up regulator (lower connection) is correctly and firmly positioned. If this is not so, no charge-air-pressure controlled full-load enrichment takes place.
Absence of full-load enrichment can lead to serious engine damage.



15. Testing and adjusting the primary(system) pressure:

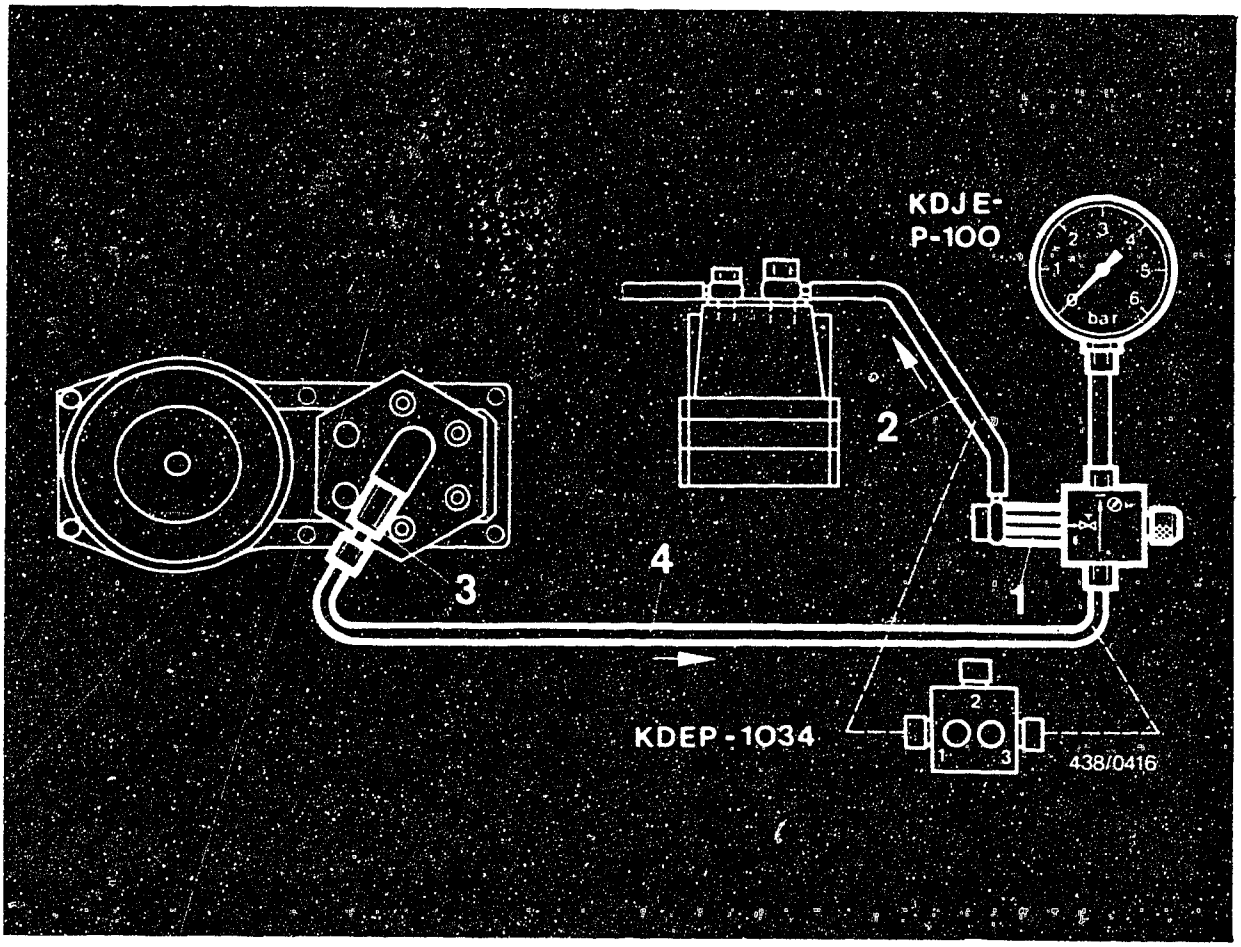
15.1 Mounting the pressure tester KDJE-P100 (formerly KDEP 1034):

The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a).

Since the end of 1979 the pressure tester KDJE-P100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional control valve are identified by symbols:

A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.



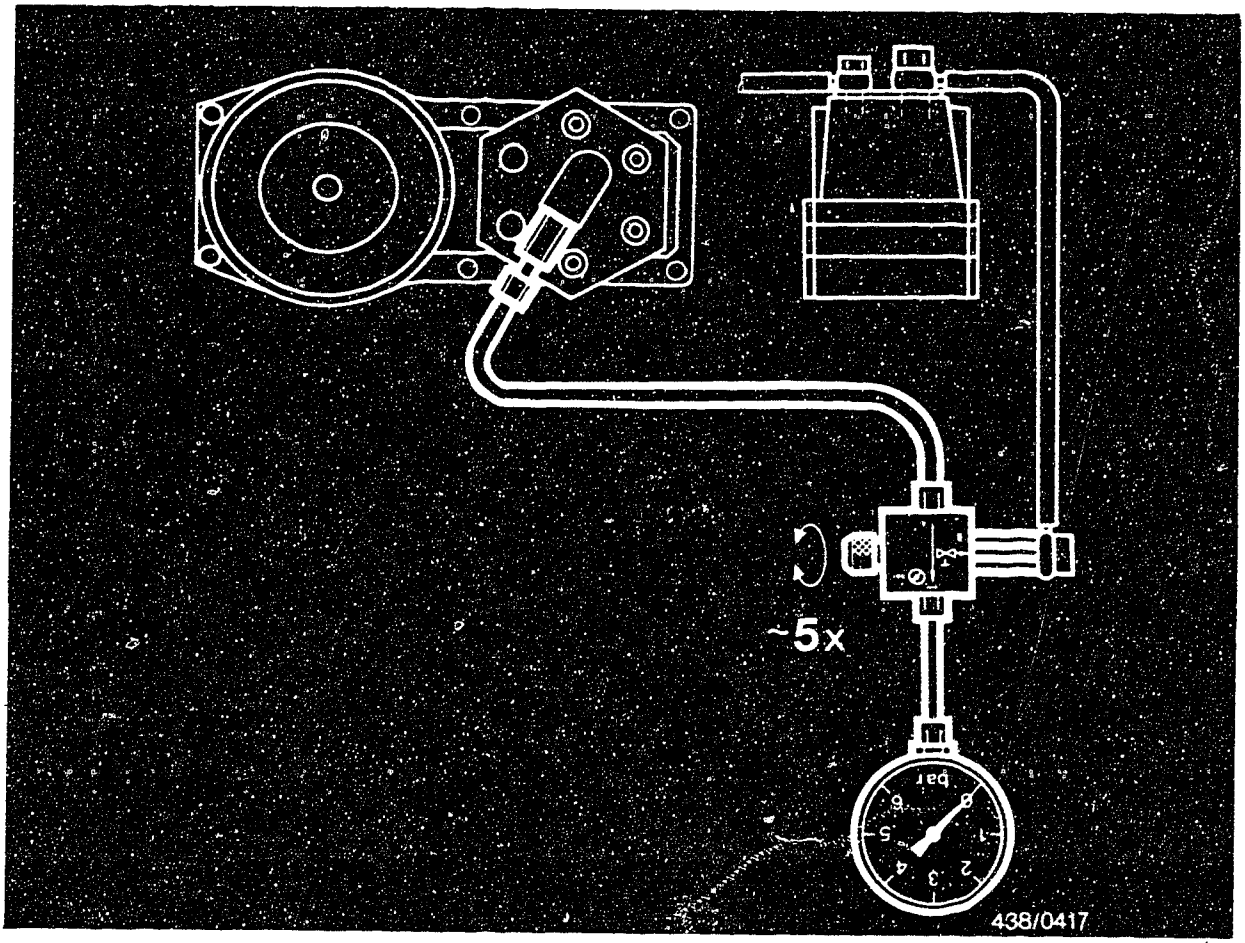
The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.

Fitting is carried out using connecting-parts set KDJE-P 100/10.

Screw the adapter from the connecting-parts set with a sealing ring onto connection B or 1 of the directional-control valve (1).

Unscrew the control-pressure line (to the warm-up regulator) from the fuel distributor and connect it to the adapter (2).

Screw the connecting part of the connecting parts set to the control-pressure connection of the fuel distributor (3) and connect it to connection A or 3 of the directional-control valve via a hose (4).



15.2 Bleeding the pressure tester

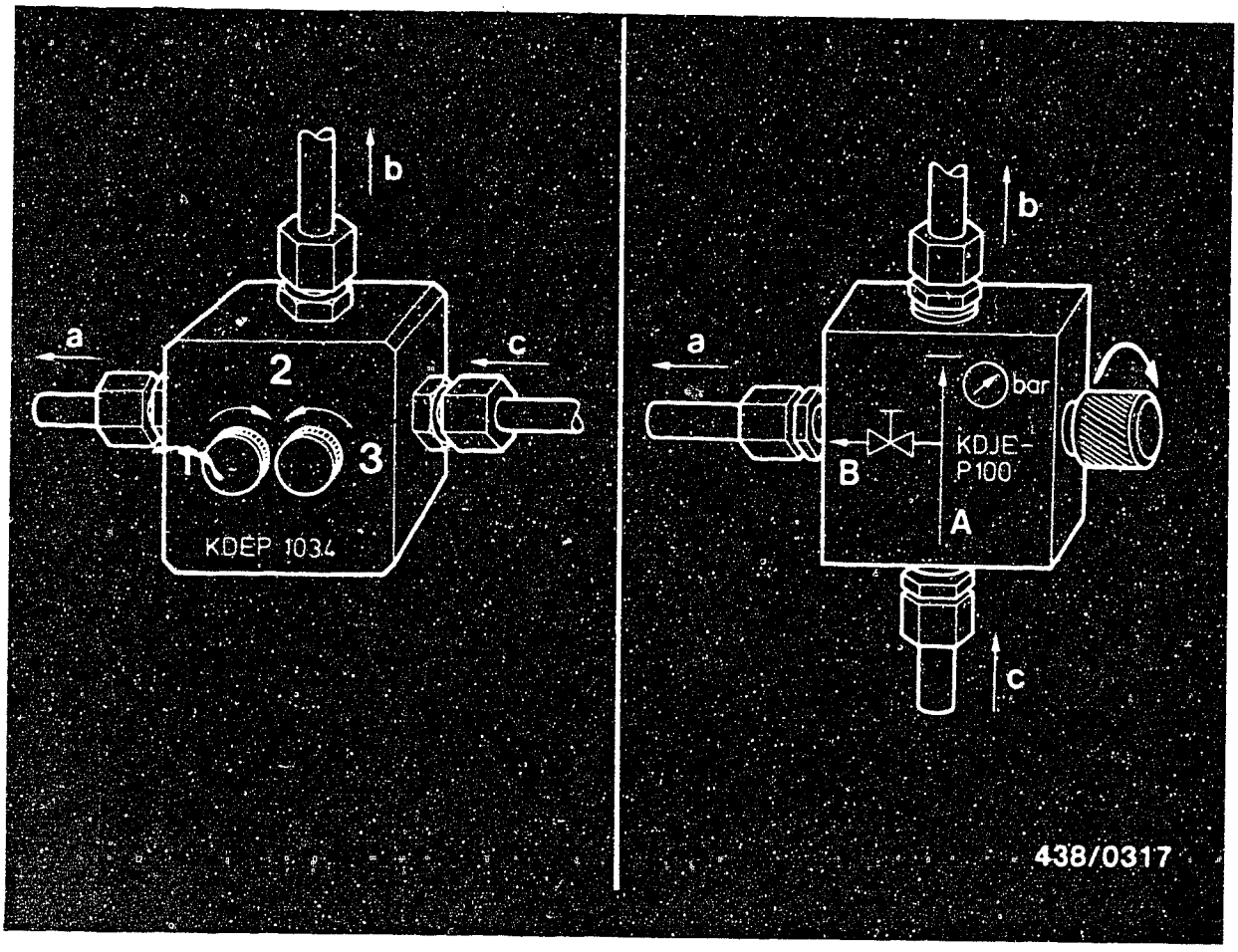
Disconnect the electric plug from the warm-up regulator and from the auxiliary-air device. Let the pressure gauge hang down (hose fully extended).

Switch on the electrical fuel pump by bridging the electrical safety circuit.

Open and close the valve screw of the directional-control valve (valve screw 1 in the case of KDEP 1034) in a 10-second rhythm about 5 times.

Then hang the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood).

Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).



a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

15.3 Testing the primary pressure:

The test is performed with the engine switched off.
The temperature of the engine is not important.
Close the valve screw of directional-control valve KDJE-P100.
In the case of KDEP 1034, close valve screw 1,open valve screw 3.

Switch on the electric fuel pump by bridging the electrical safety circuit.
The pressure gauge now indicates the primary pressure.

Fuel distributor Part No.	Test specifications - Primary pressure (gauge pressure)
0 438 100 093	5.1...5.8 bar (5.2...5.9 kgf/cm²)

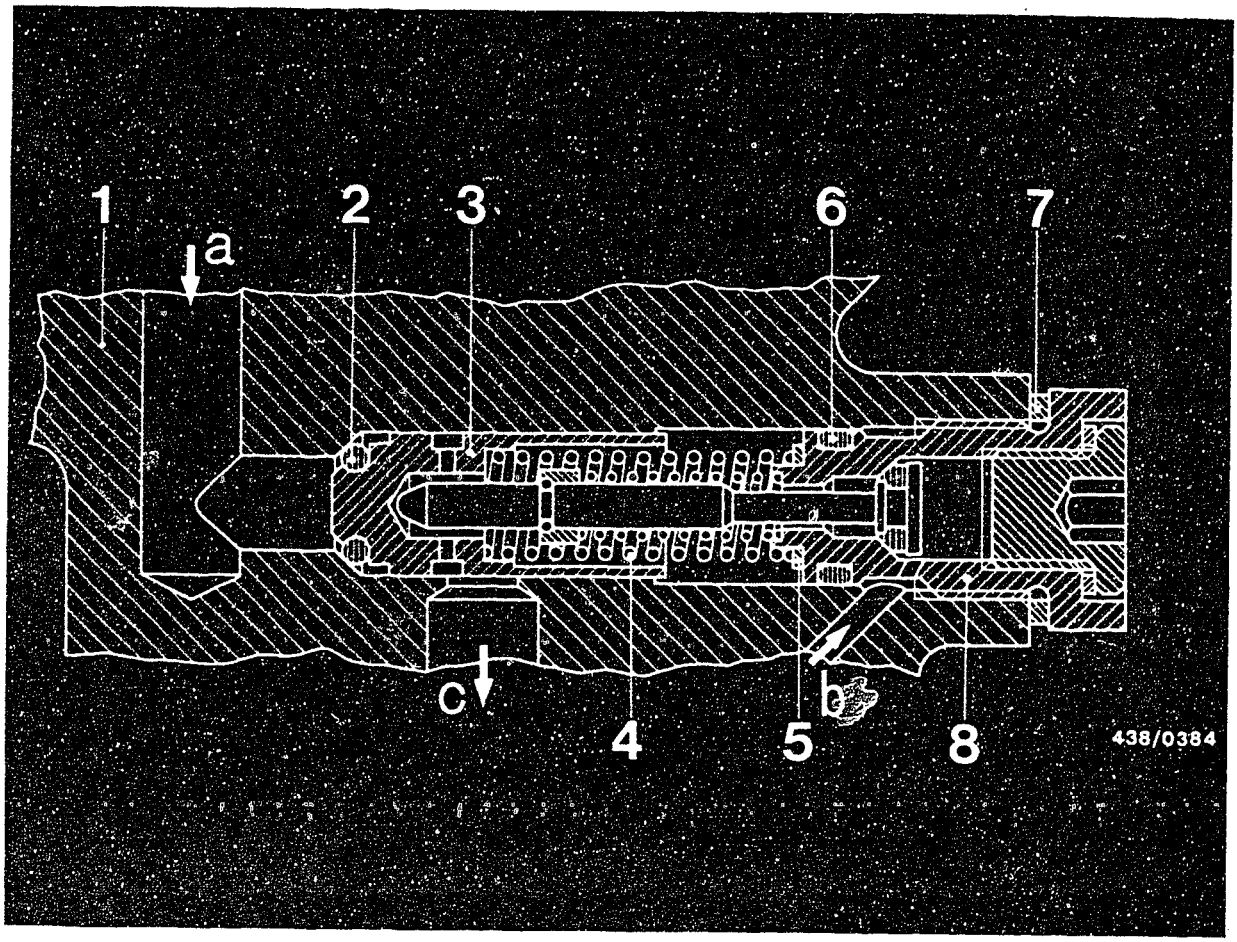
Possible causes for too low a primary pressure:

- Fuel supply faulty.
(Delivery of electric fuel pump too low).

- Primary pressure set incorrectly.
A precondition for readjustment of the primary pressure is always that the fuel supply is in order.
Nominal fuel-delivery value = 960 cm³/30 s.

Possible causes for too high a primary pressure:
- A restriction in the return line leading to the fuel tank.

- Primary-pressure regulator set incorrectly.
For this reason, before readjusting too high a primary pressure, always first check the condition of the return line leading to the fuel tank.

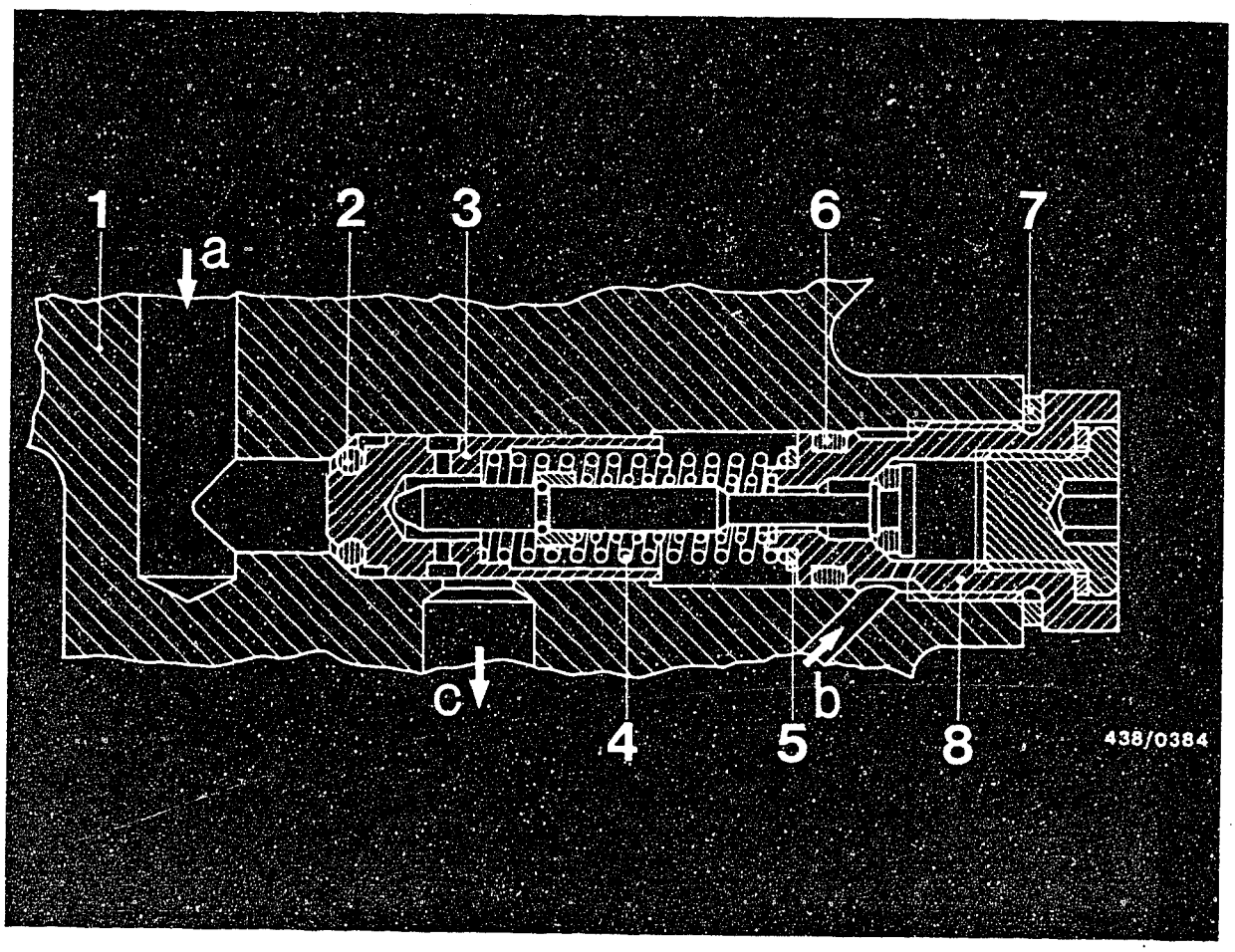


a = Primary pressure
b = From warm-up regulator
c = Fuel return
1 = Fuel-distributor housing
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = O-ring
7 = Flat seal ring
8 = Screw plug

15.4 Adjusting the primary pressure:

Primary-pressure adjustment values:

Fuel distributor Part No.	Adjustment values - Primary pressure
0 438 100 093	5.3...5.5 bar (5.4...5.6 kgf/cm²)

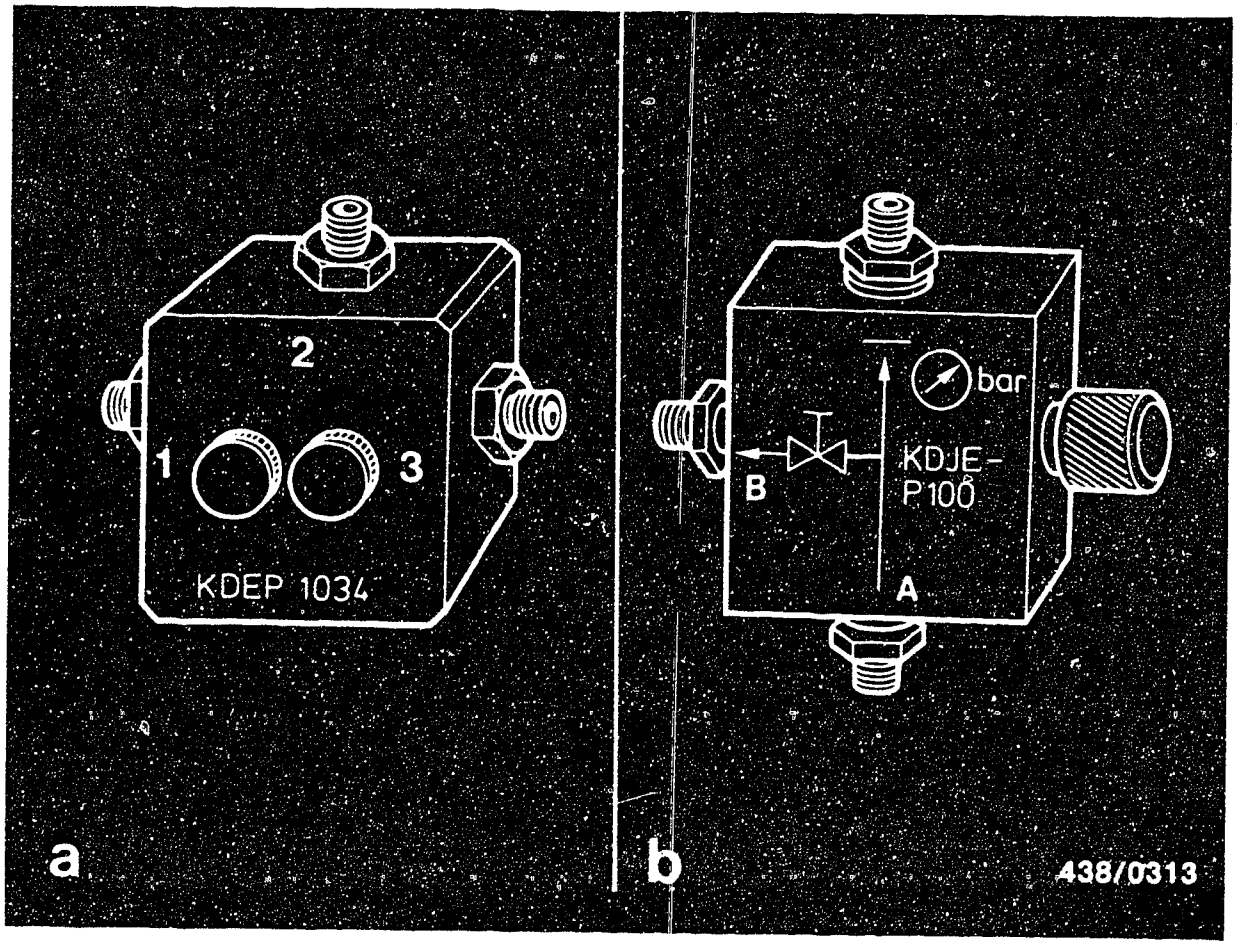


The primary pressure is readjusted by replacing the shims (Item 5).

Note:
0.1 mm more of shim thickness means about 0.15 bar pressure increase and vice versa.

To do this, screw out the large screw plug (Item 8) together with the push valve. After carrying out the adjustment, always fit the screw plug with a new flat seal ring (Item 7) and O-ring (Item 6).

The control piston (Item 3) of the primary-pressure regulator must not be lost. It was matched specially to the fuel distributor housing in the manufacturing plant and therefore is the only part of the primary-pressure regulator which must not be replaced.



16. Testing the entire fuel system for leaks.

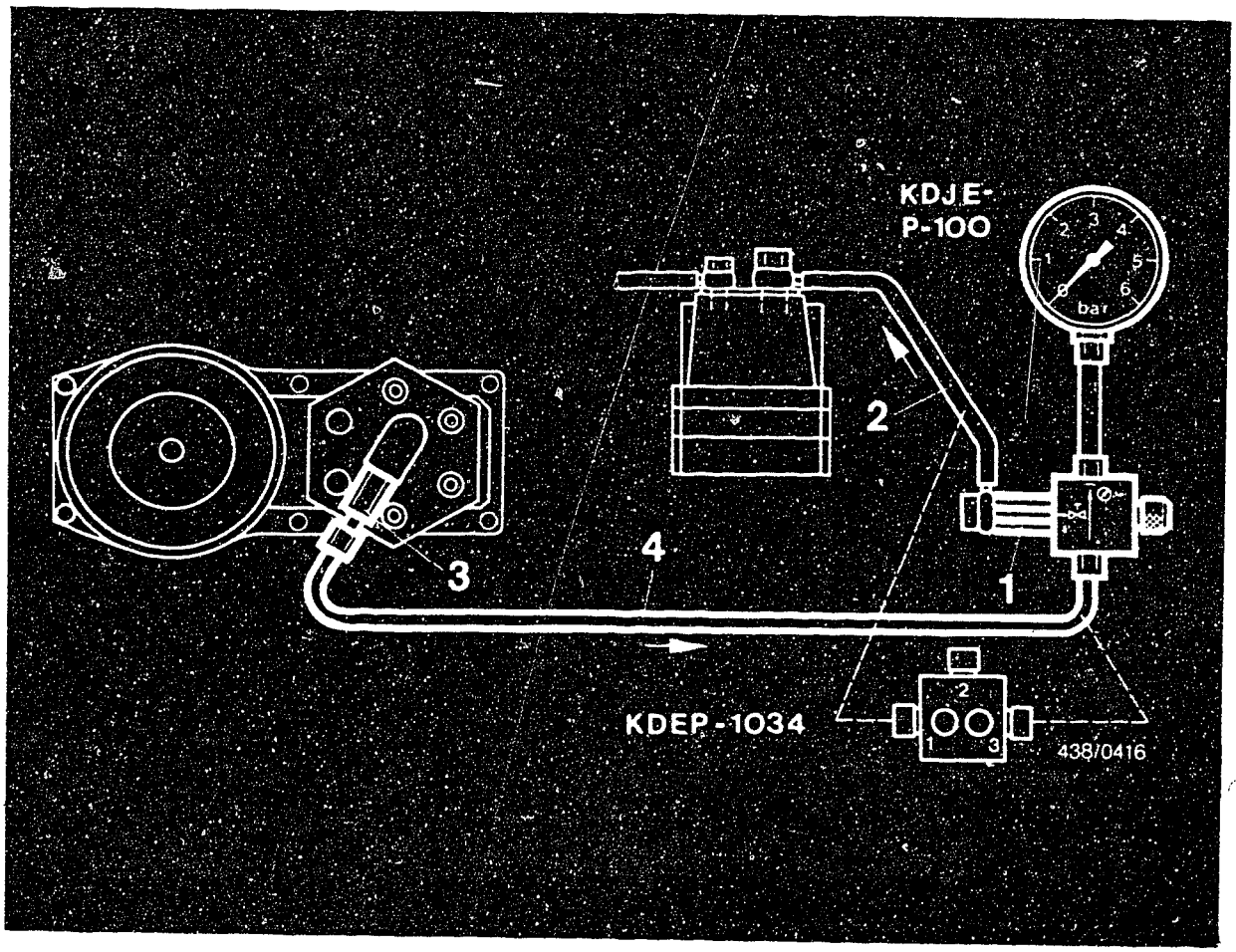
16.1 Mounting the pressure tester KDJE-P100 (formerly KDEP 1034):

The pressure tester KDEP 1034 is equipped with a three-way valve with 2 separate valve screws. The connections of the directional-control valve are numbered (Fig. a).

Since the end of 1979 the pressure tester KDJE-P100 has been supplied. Its directional-control valve has only one valve screw (Fig. b). The connections of this directional control valve are identified by symbols:

A = Inlet (from the fuel distributor)
B = Outlet (to the warm-up regulator)

Caution:
When the directional-control valve is not in use, always keep the valve screw(s) open in order to relieve the pressure on the seal rings.



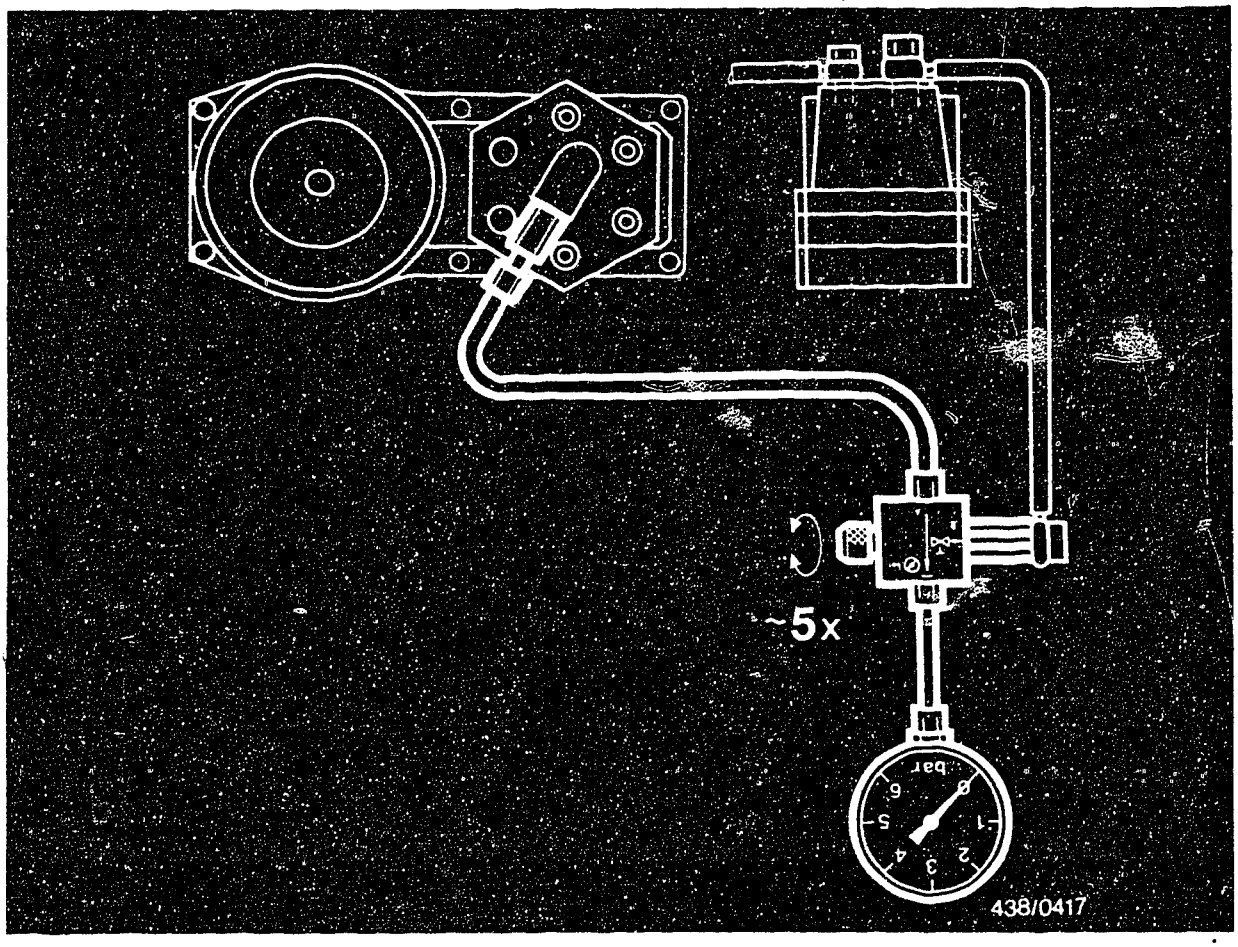
The directional-control valve of the pressure tester is connected into the control-pressure line from the fuel distributor to the warm-up regulator.

Fitting is carried out using connecting-parts set KDJE-P 100/10.

Screw the adapter from the connecting-parts set with a sealing ring onto connection B/1 of the directional-control valve (1).

Unscrew the control-pressure line (to the warm-up regulator) from the fuel distributor and connect it to the adapter (2).

Screw the connecting part of the connecting-parts set to the control-pressure connection of the fuel distributor (3) and connect it to connection A or 3 of the directional-control valve via a hose (4).



16.2 Bleeding the pressure tester

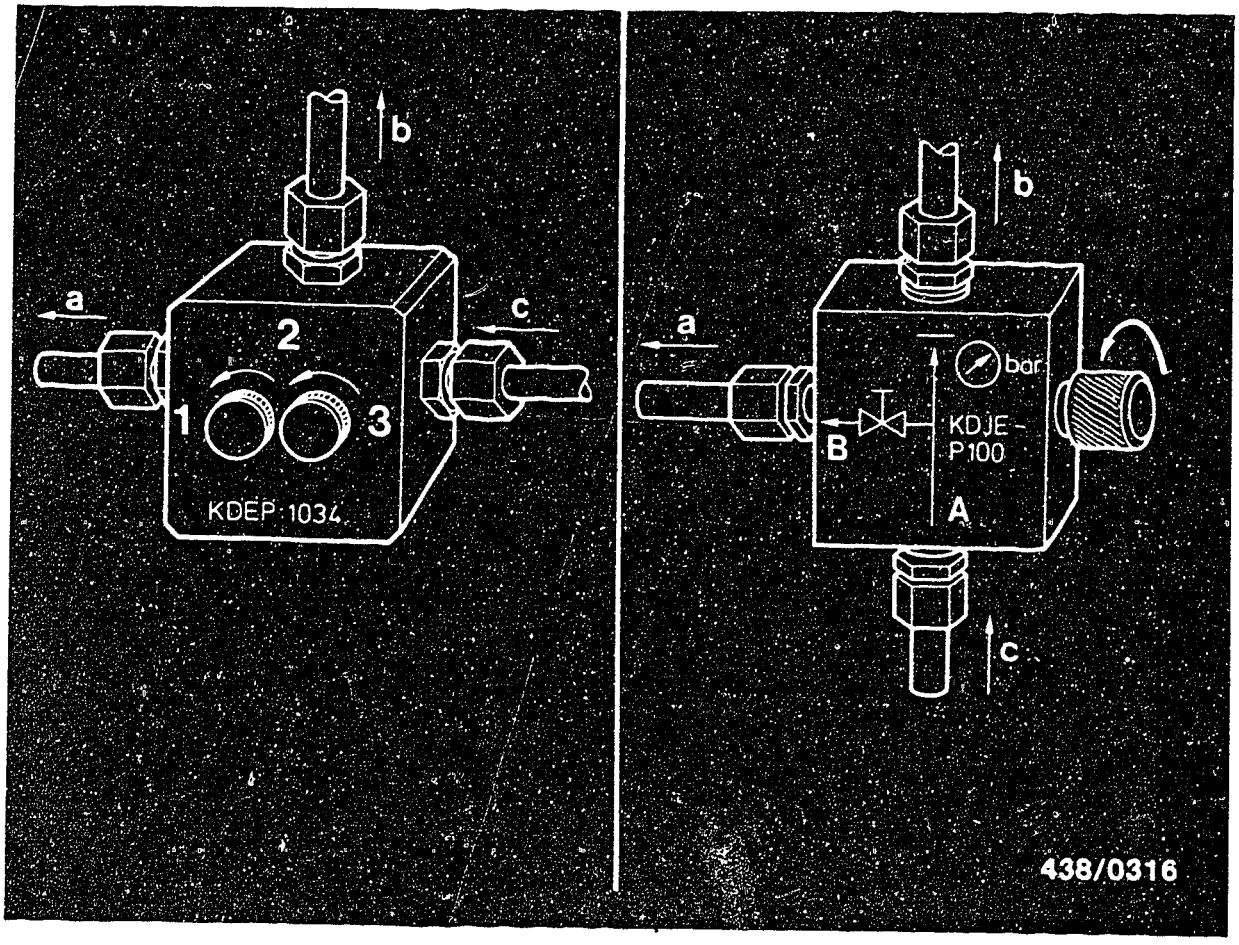
Disconnect the electric plug from the warm-up regulator and from the auxiliary-air device. Let the pressure gauge hang down (hose fully extended).

Switch on the electrical fuel pump by bridging the electrical safety circuit.

Open and close the valve screw of the directional-control valve (valve screw 1 in the case of KDEP 1034) in a 10-second rhythm about 5 times.

Then hang down the pressure gauge from a suitable support (e.g. from one of the struts under the engine hood).

Open valve screw of directional-control valve (both screws in the case of KDEP 1034) (turning to the left).

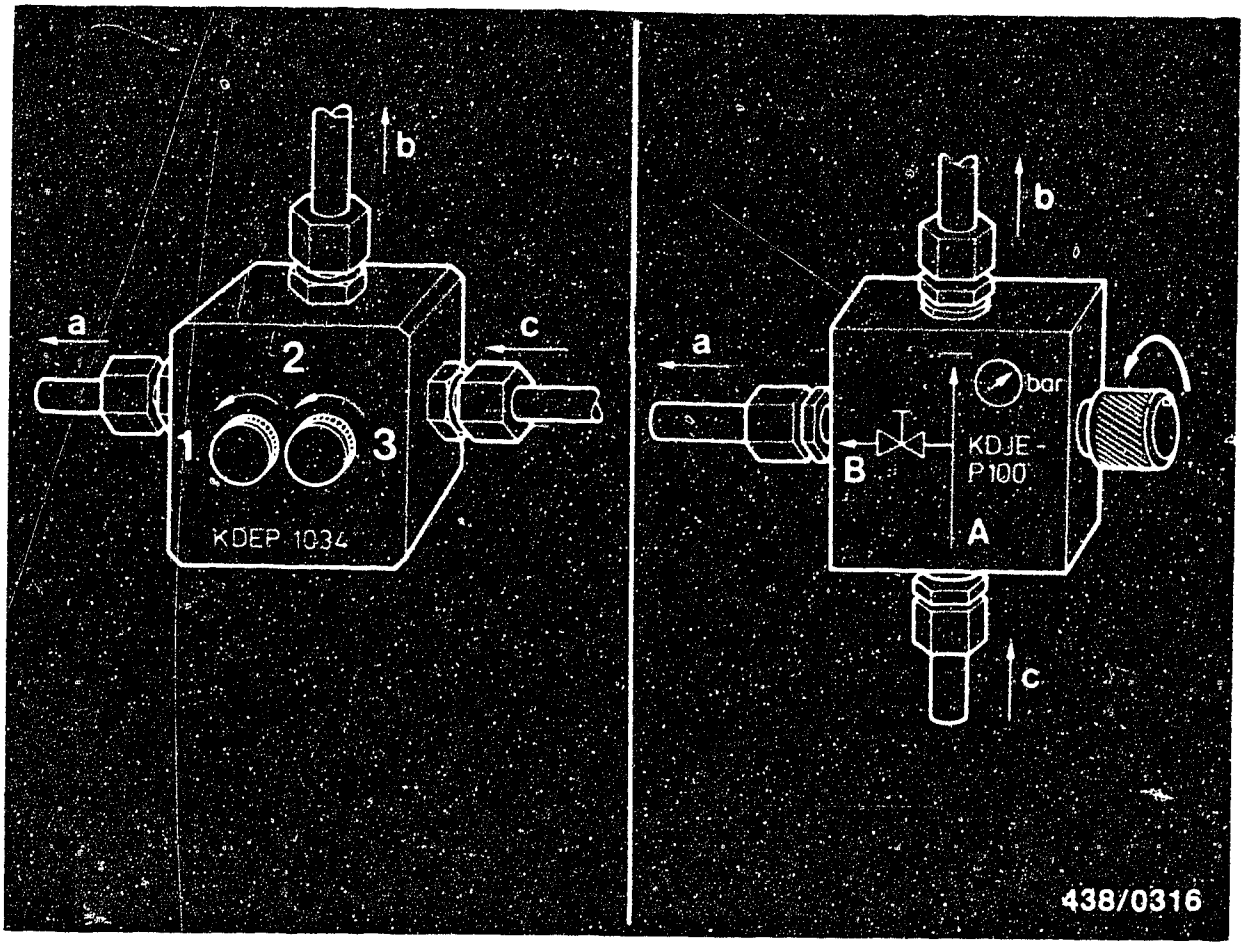


a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

16.3 Leak test

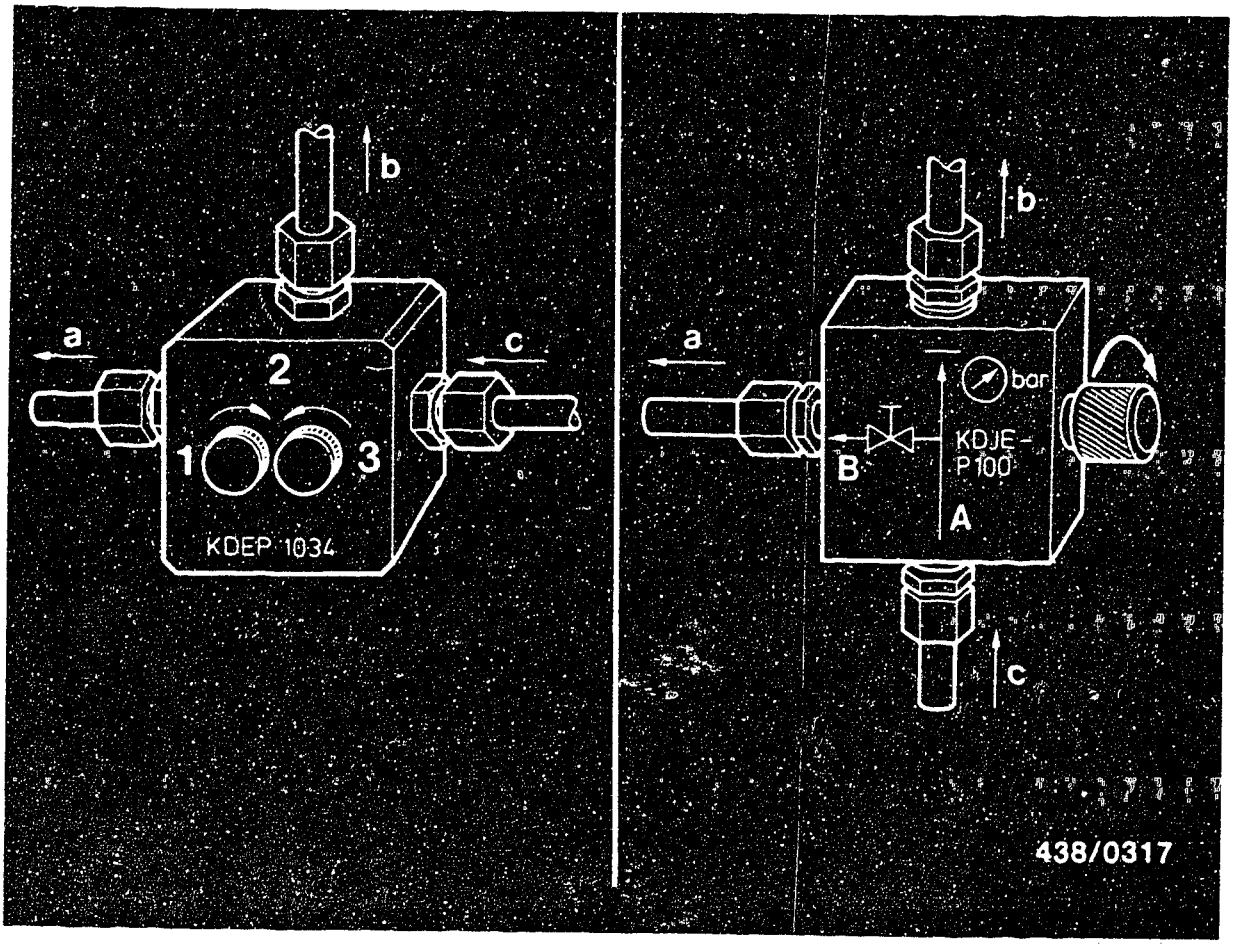
The test is performed with the engine switched off.

Make the test with a warm engine but not immediately after the engine has been operated at a high temperature.
Open the valve screw of the directional-control valve (both valves in the case of KDEP 1034).



Switch on the electric fuel pump by bridging the electrical safety circuit until the warm-up regulator has ceased to operate ("warm" control pressure).
Switch the electric fuel pump off again and observe the drop in pressure on the pressure gauge.

Test specifications for leak test:
Minimum pressure after:
10 minutes: 2.0 bar (2.1 kgf/cm²) gauge pressure
20 minutes: 1.7 bar (1.8 kgf/cm²) gauge pressure



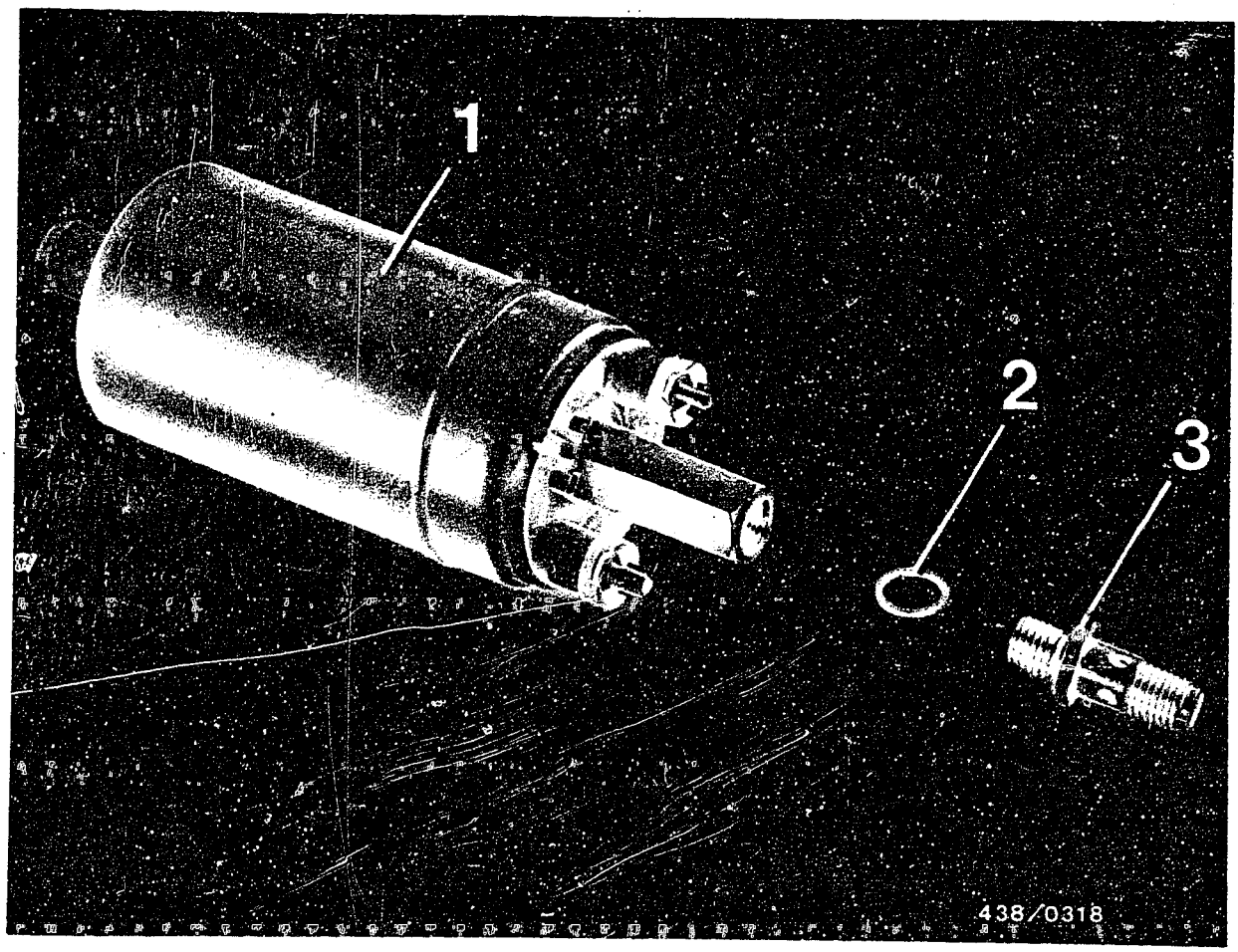
a = To warm-up regulator
b = To pressure gauge
c = From fuel distributor

If the pressure drops too quickly, repeat the test with the control-pressure circuit disconnected.

Position of the valve screws:
Close the valve screw of the directional-control valve KDJE-P100.
In the case of KDEP 1034, close valve screw 1, open valve screw 2.

If the same result is found, the leak is in the primary-pressure circuit.

If the test results are correct during the second test, the leak is in the control-pressure circuit.

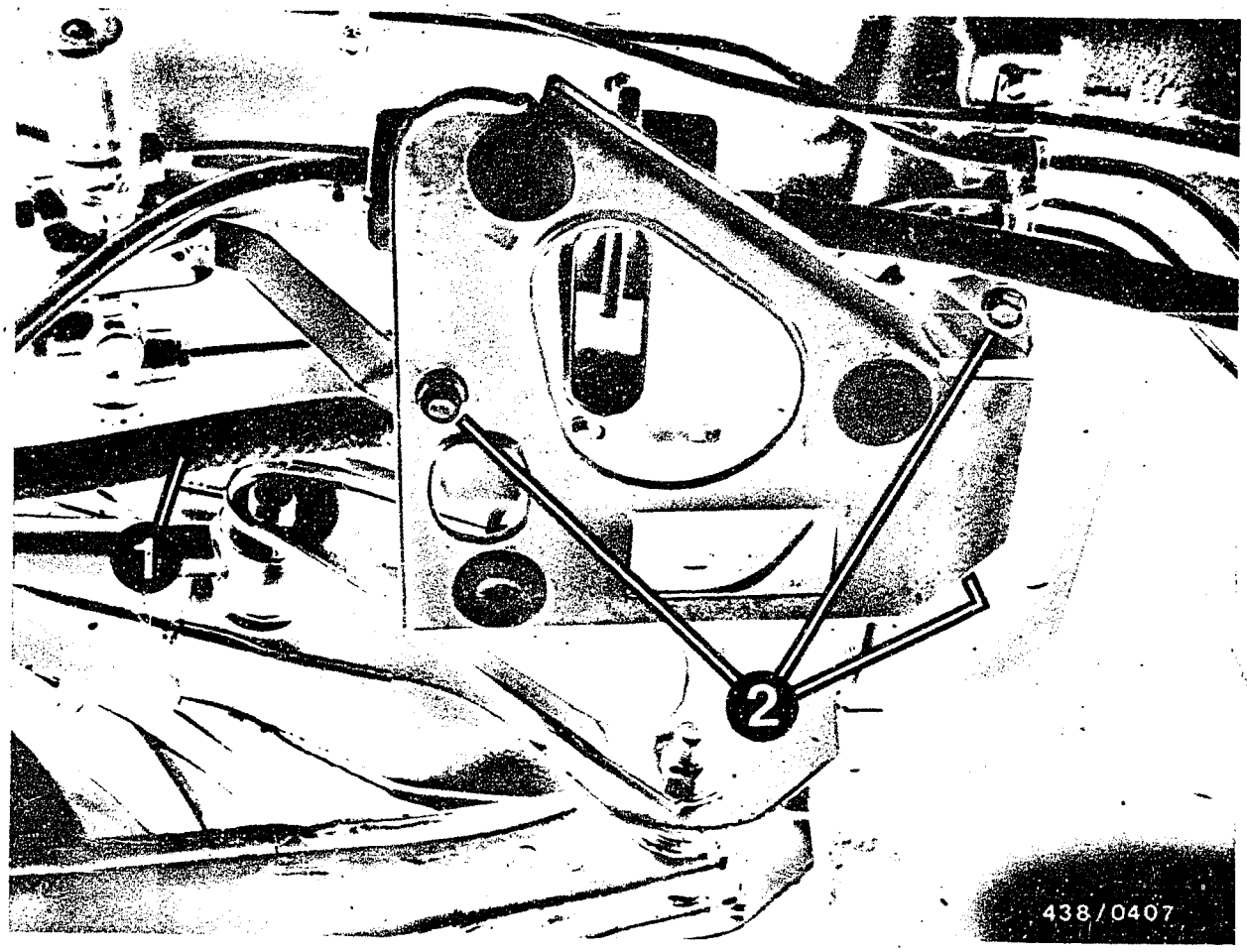


1 = Electric fuel pump
2 = Flat seal ring
3 = Tube fitting with non-return valve

16.4 Possible causes of a defect in the primary-pressure circuit:

- Non-return valve in the pressure connection piece of the electric fuel pump has a leak.

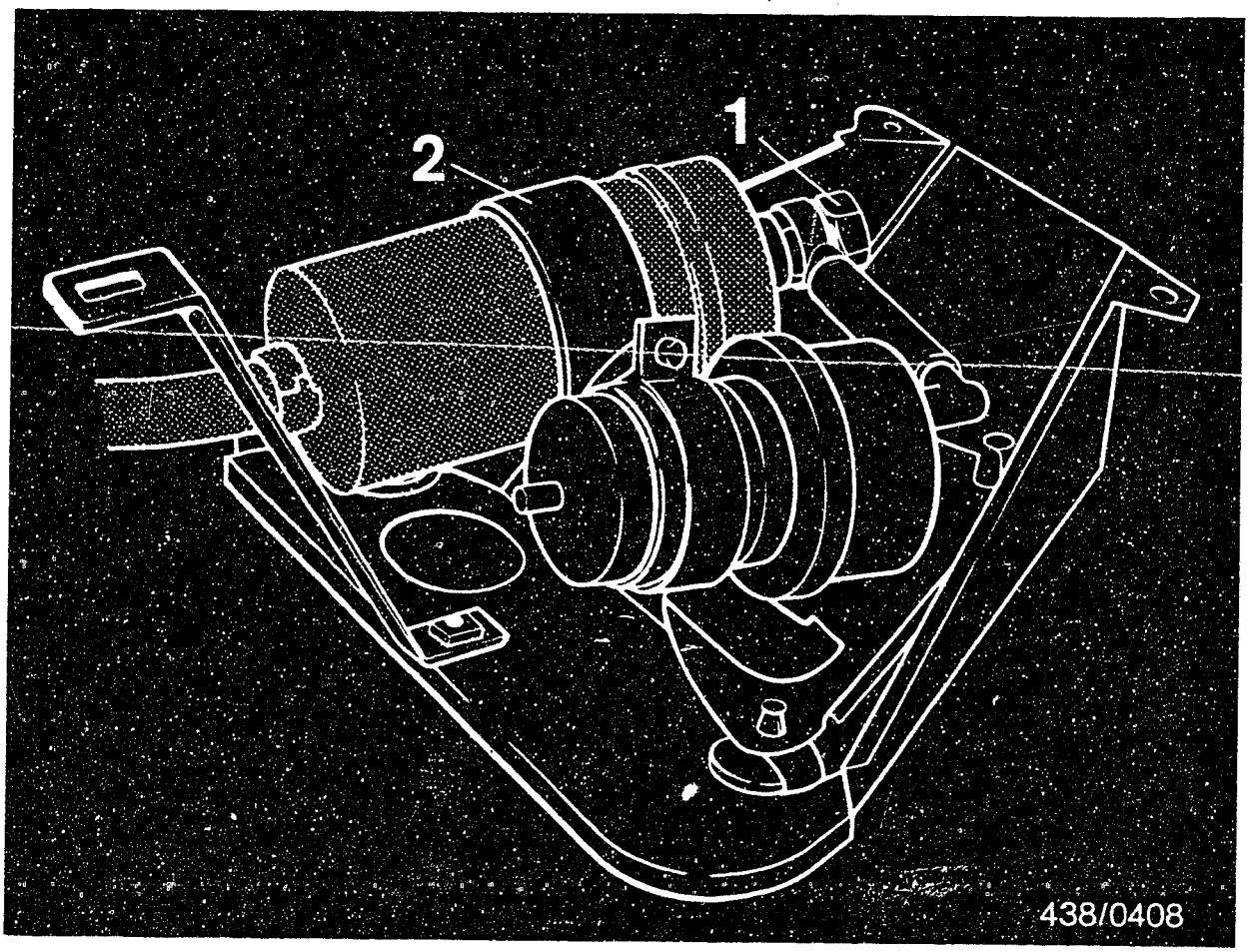
The non-return valve is built into the tube fitting and cannot be replaced.



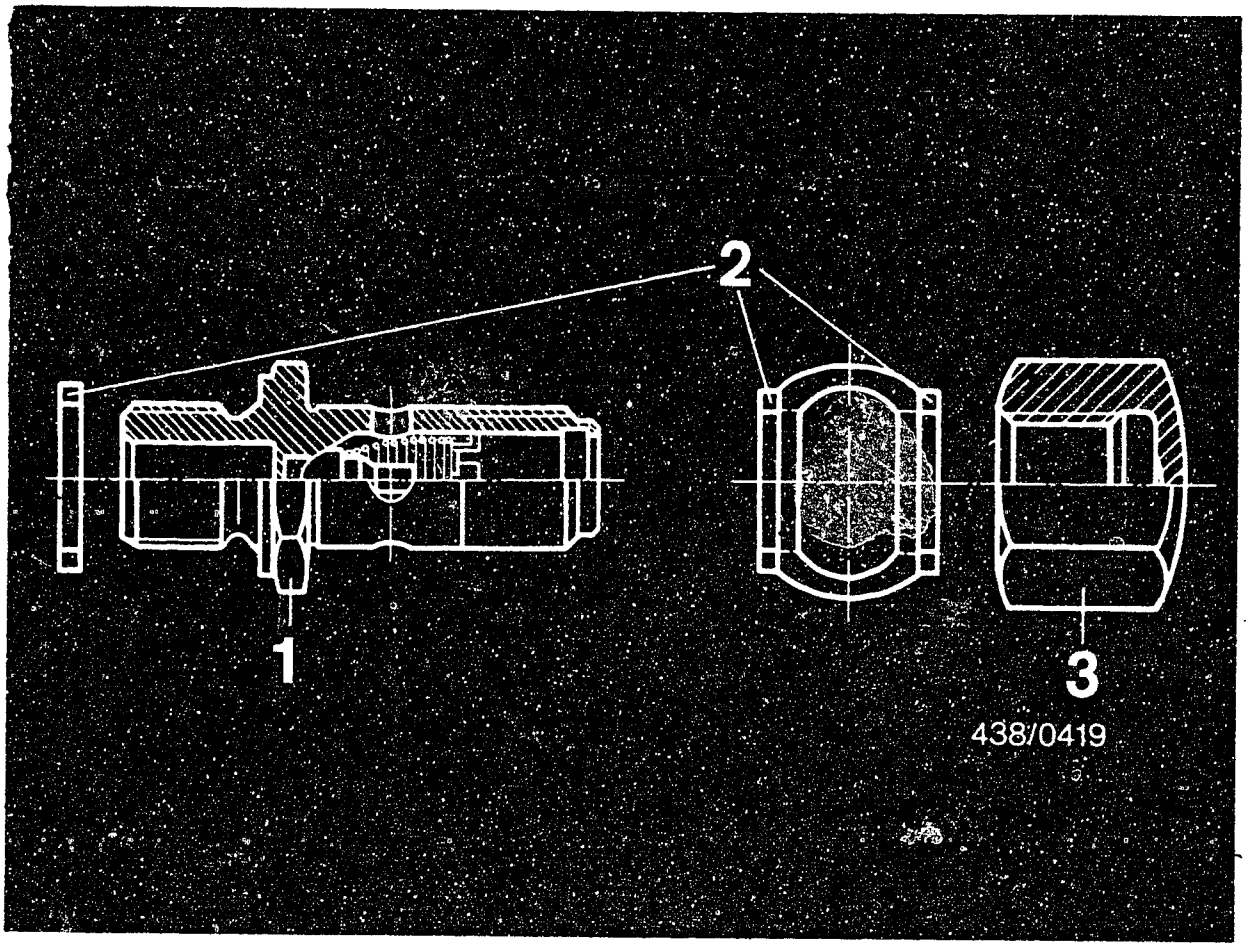
In order to avoid a complete replacement of the electric fuel pump if the non-return valve is leaking, a parts set has been produced with a separate non-return valve which can be used in the electric fuel pump 0 580 254 984 used in the Volvo B21 ET.

Part number of parts set: 1 587 010 003.
Contents: 1 tube fitting with built-in non-return valve
3 flat seal rings
1 cap nut

Installing the parts set:
Pinch off the intake hose (1) of the electric fuel pump (e.g. using hose clamper W 157 from Matra Co.).
Unscrew the three fastening screws (2) on the bracket and pull the bracket down somewhat so that the delivery line between the pump and the accumulator is accessible.

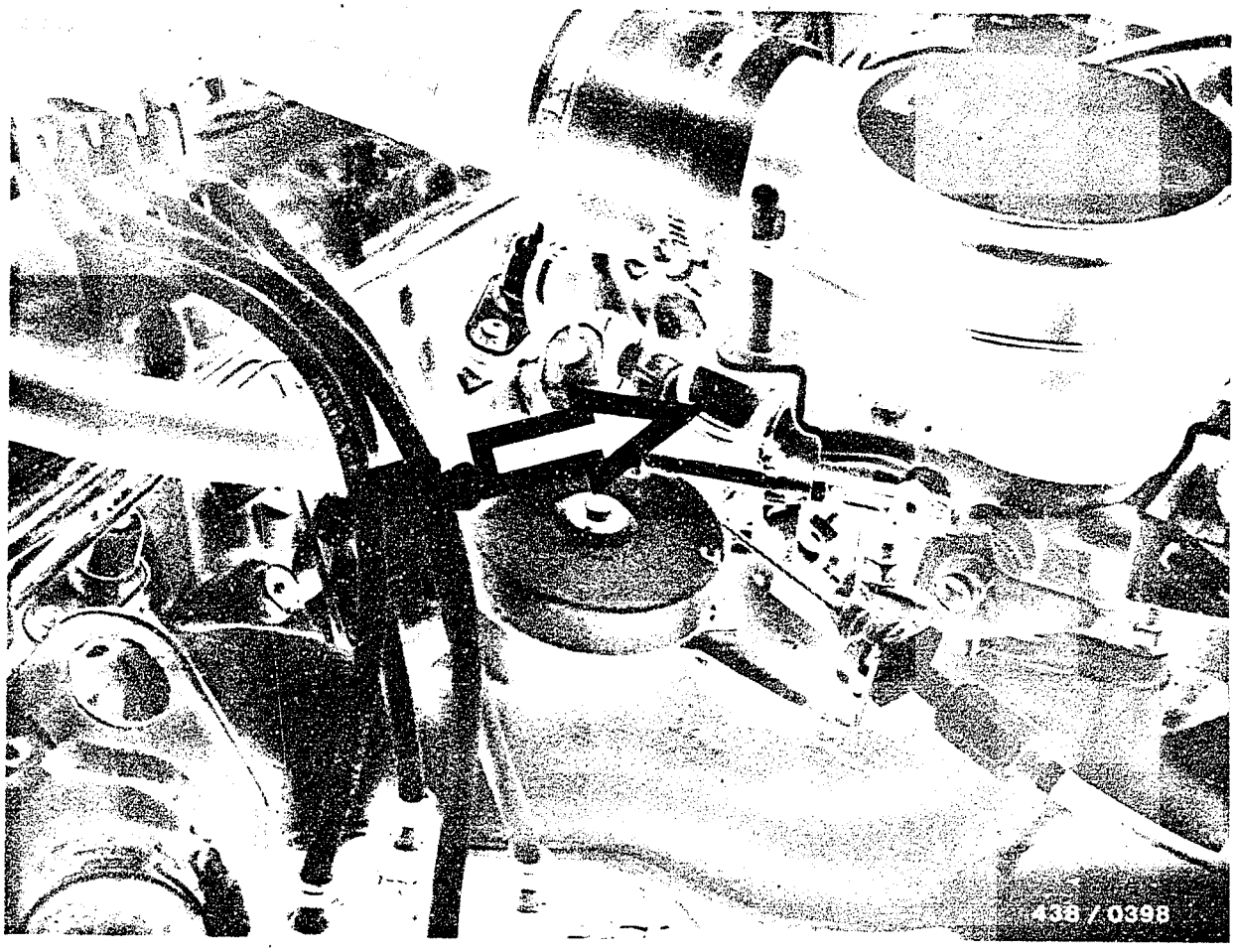


Thoroughly clean the delivery line and pressure connection piece of the electric fuel pump.
Screw off the inlet-union screw (1), collecting any escaping fuel.
Release the clamp (2) on the electric fuel pump and pull the pump back a little.



1 = Tube fitting with built-in non-return valve
2 = Flat seal rings
3 = Cap nut

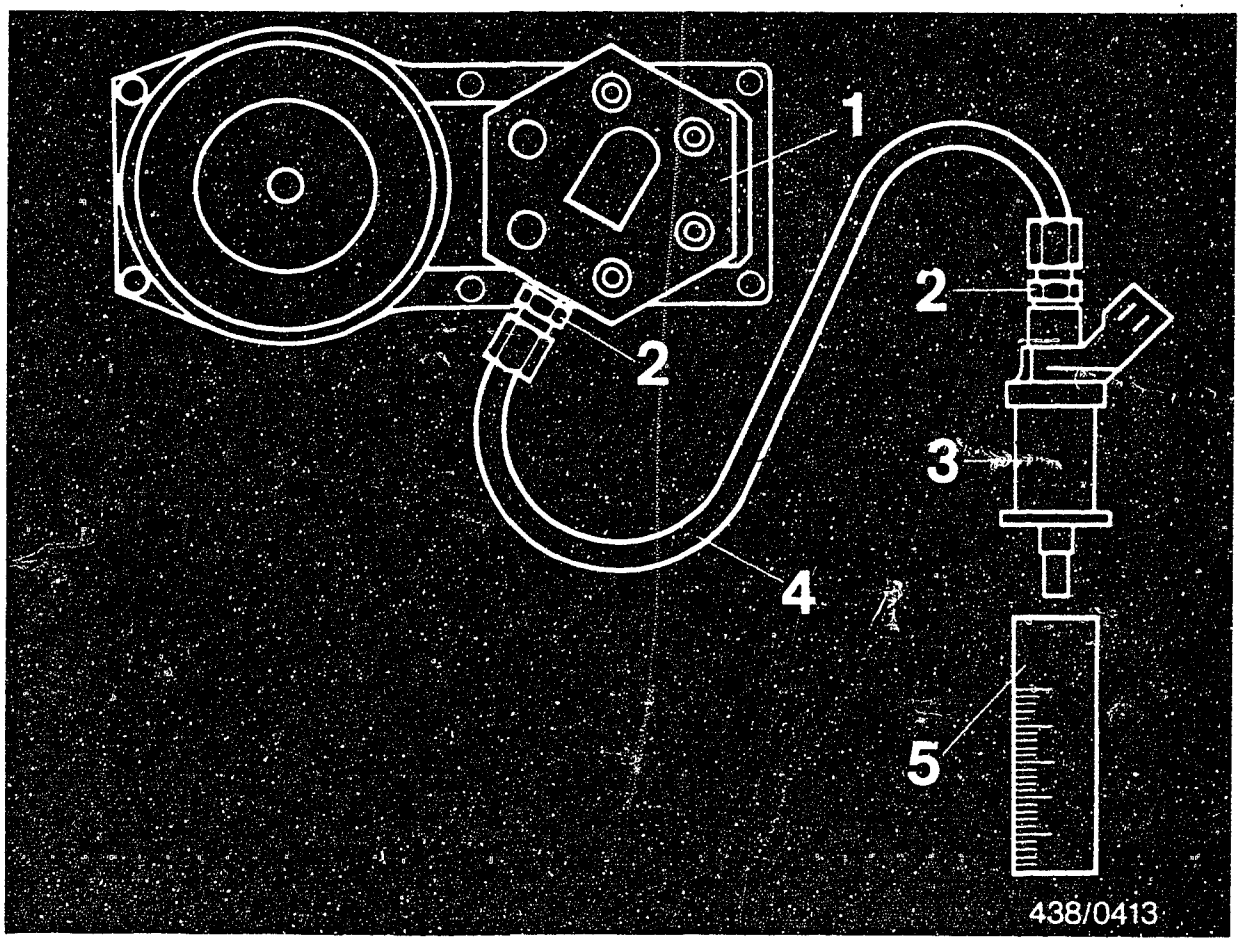
The defective original non-return valve remains in the pressure connection piece of the electric fuel pump.
Screw the new non-return valve from the parts set with a seal ring into the pressure connection piece and tighten to a torque of 17...25 Nm.
Connect the delivery line and tighten the clamp on the pump.
Remount the complete bracket and remove hose clamper from intake hose.
Check all connections for leaks with the electric fuel pump in operation.



- Cold-start valve has a leak.

Remove the start valve for checking. It is mounted in the throttle-valve housing underneath the air supply tube.

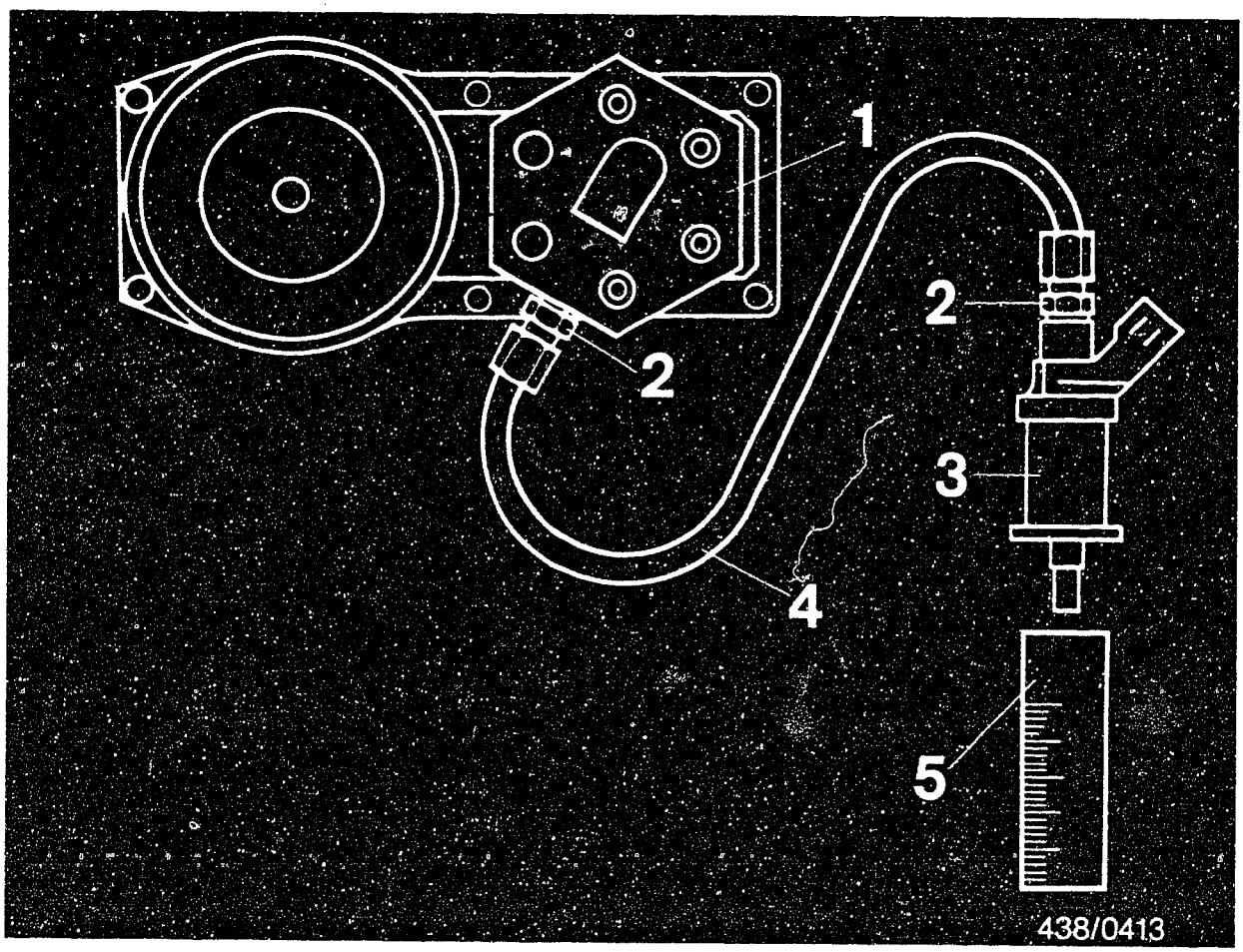
The fuel line should actually remain connected during testing. Since this is not possible due to the steel fuel lines, the start valve can be directly connected to the fuel distributor as follows.



1 = Fuel distributor
2 = Double threaded connectors M 8x1/M 12x1.5 (commercially available)
3 = Cold-start valve
4 = Hose from KDJE-P 100 (previously KDEP 1034)
5 = Graduate

Unscrew the fuel line to the start valve from the fuel distributor. Connect the start valve, using two commercially available double threaded connectors M 8x1/M 12x1.5, and one of the two hoses of the pressure tester KDJE-P 100 (previously KDEP 1034) directly to the fuel distributor.

Switch on the electric fuel pump by bridging the electrical safety circuit so that primary pressure is applied to the start valve.



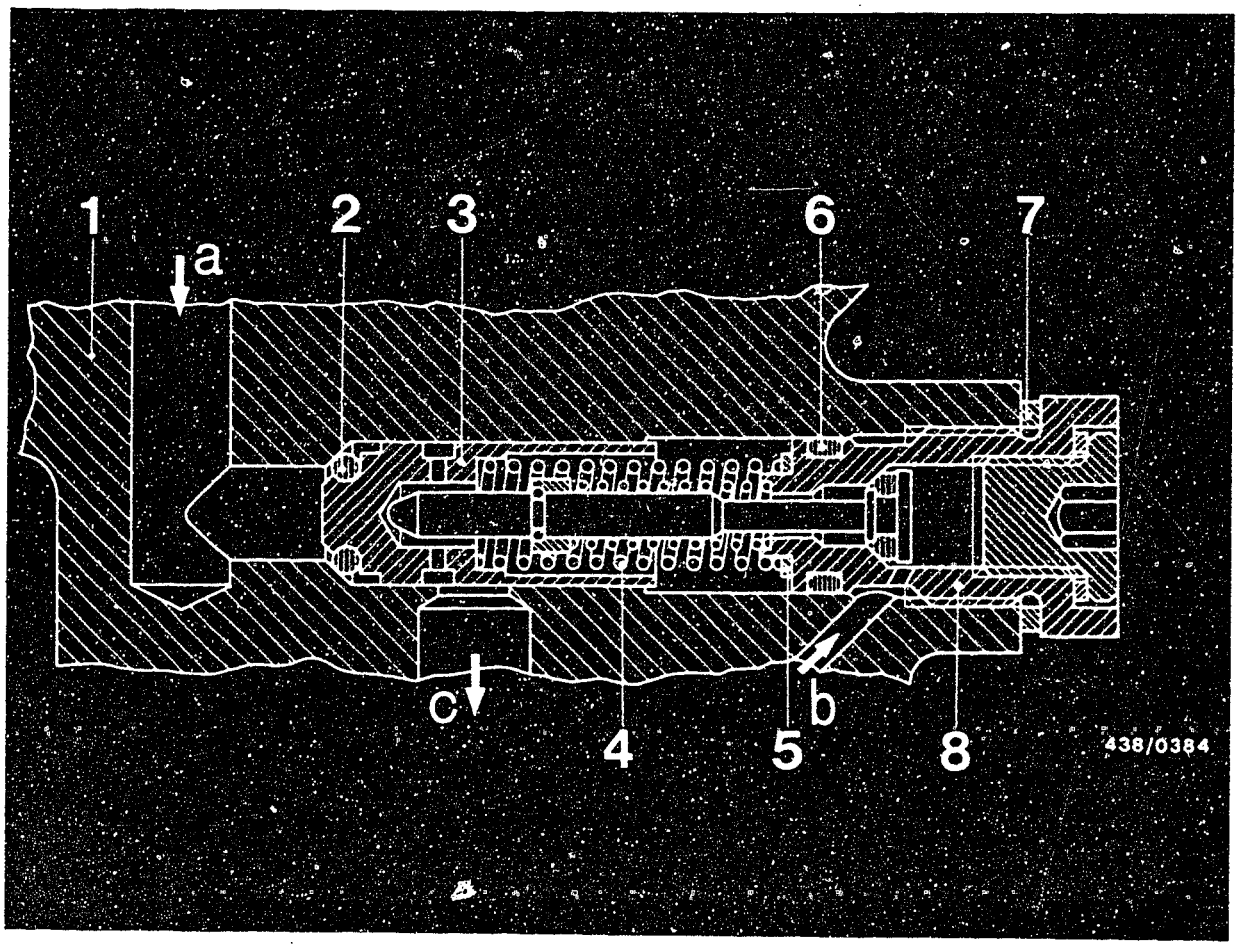
Dry off the nozzle of the cold-start valve.

No drops must fall from the nozzle of the start valve within the next minute. Even when shaken and knocked, the start valve must not leak.

Switch the electric fuel pump off again.

Replace the cold-start valve if leaky.

If a leaky start valve has been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.
Idle-speed adjustment is described on Coordinates F 12.



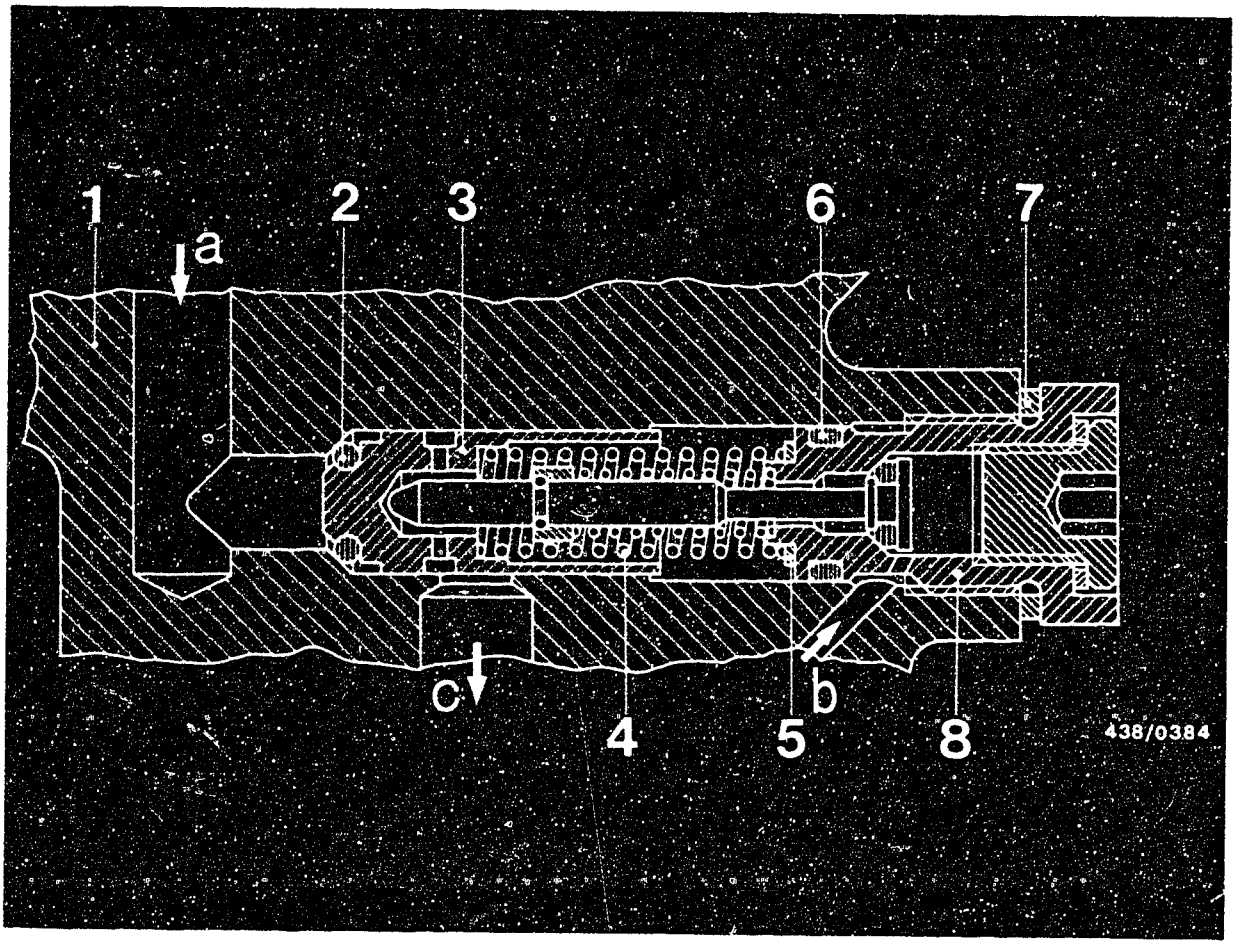
a = Primary pressure
b = From warm-up regulator
c = Fuel return
1 = Fuel-distributor housing
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = O-ring
7 = Flat seal ring
8 = Screw plug

● The seal ring on the control piston of the primary-pressure regulator has a leak.

Replace seal ring:

Clean the fuel distributor in the area of the primary-pressure regulator.

Unscrew the large screw plug (8) with complete push valve. Remove shims (5), control spring (4) and control piston (3).

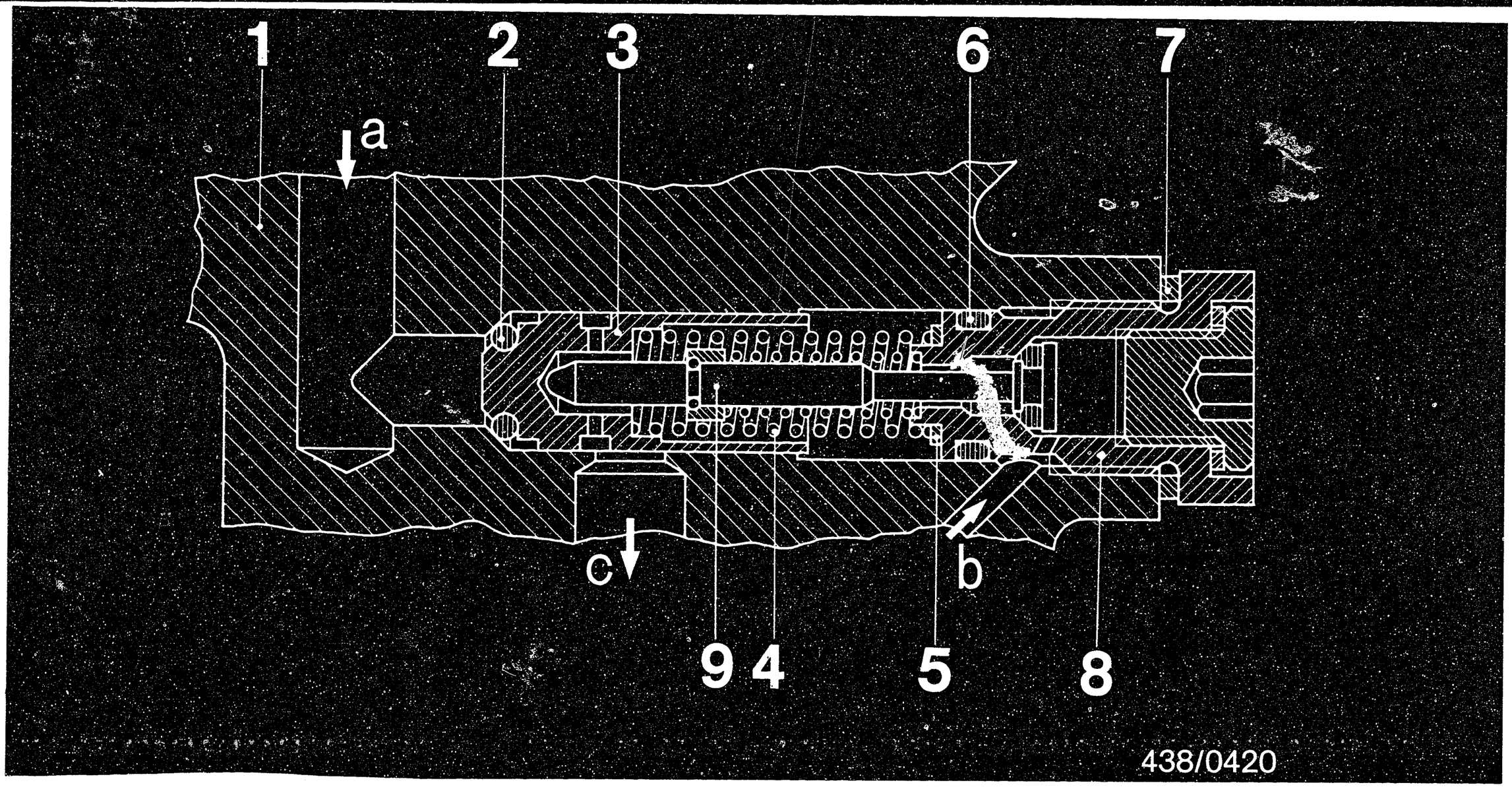


a = Primary pressure
b = From warm-up regulator
c = Fuel return
1 = Fuel-distributor housing
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = O-ring
7 = Flat seal ring
8 = Screw plug

Replace O-ring 2, install control piston and control spring.

Screw in screw plug with complete push valve and with shims (as removed), and with new seal rings (6) and (7).

Finally check primary pressure (Coordinates D 10) and, if necessary, adjust by changing the shims (5).



a = Primary pressure
b = From warm-up regulator
c = Fuel return

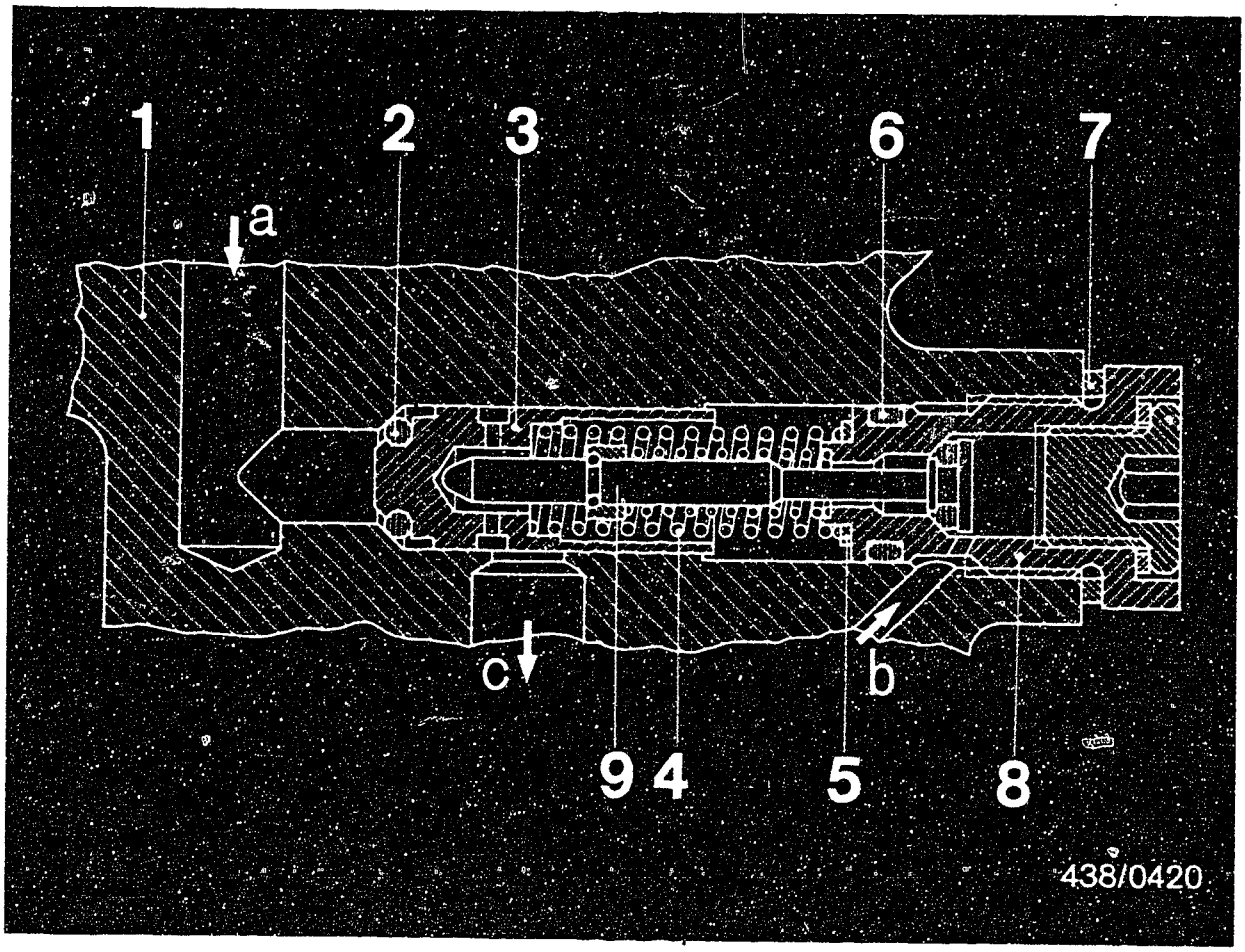
1 = Fuel-distributor housing
2 = O-ring
3 = Control piston

4 = Control spring
5 = Shims
6 = O-ring

7 = Flat seal ring
8 = Screw plug
9 = Push valve

16.5 Possible causes of a defect in the control-pressure circuit:

The push valve (9) in the control-pressure regulator has a leak.
The seal ring of the push valve is rigidly vulcanized onto the valve needle. Therefore, if leaking occurs, the complete push valve (ready-assembled unit) must be changed.

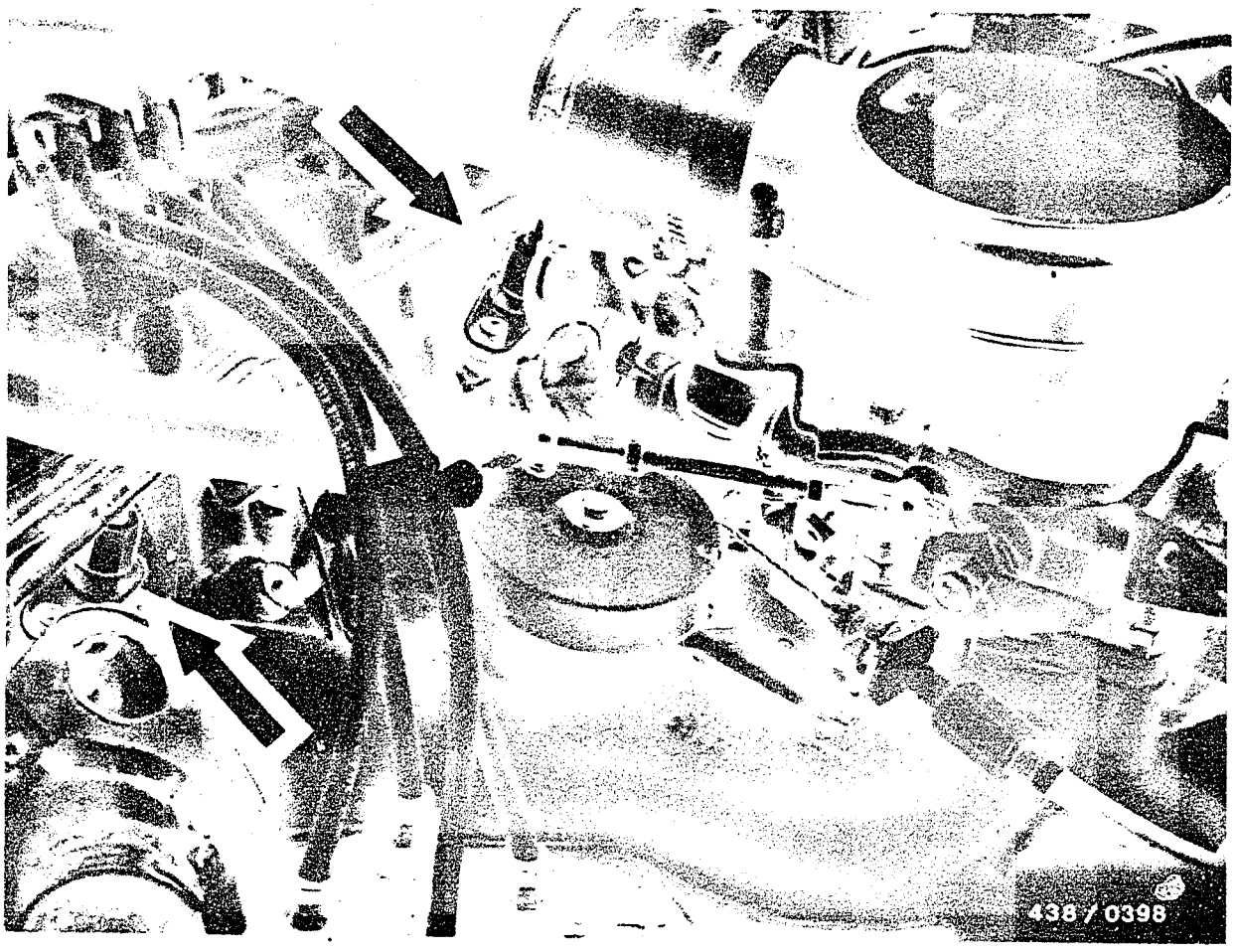


a = Primary pressure
b = From warm-up regulator
c = Fuel return
1 = Fuel-distributor housing
2 = O-ring
3 = Control piston
4 = Control spring
5 = Shim(s)
6 = O-ring
7 = Flat seal ring
8 = Screw plug
9 = Push valve

Clean the fuel distributor in the area of the primary-pressure regulator.
Unscrew the large screw plug (8) with complete push valve. Be careful with the control spring (4) and the shims (5).

Screw in the new push valve with the same number of shims (5), new O-ring (6) and flat seal ring (7).

Finally, test the primary pressure (Coordinate D 10) once more and, if necessary, adjust by changing the shims (5).



17. Checking the injection valves

Remove injection valves for checking.
When loosening the fuel lines, apply counter-force at the fixed hexagon of the injection valves.

Caution! Do not bend the steel fuel lines!

When remounting the injection valves, the cup seals on the valve stem should preferably be renewed (Volvo part) in order to prevent leaks and thus the entry of unmetered air.

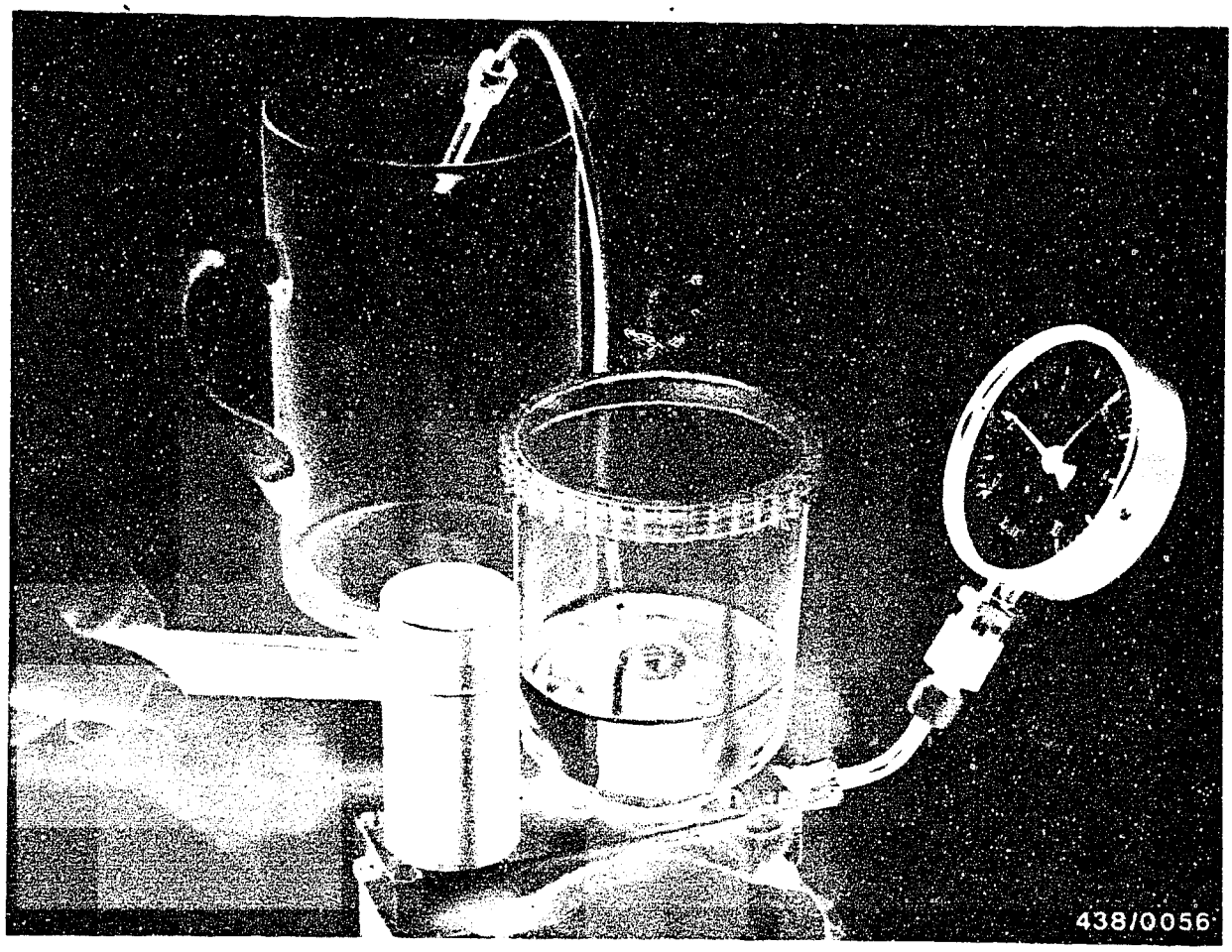
17.1 Test equipment and test media

The following testing specification refers to valve testers KDJE-P400 (previously KDEP 7452) and 0 681 200 700.

Observe the test-media specification!

Test media: Calibrating fluid (Shell K30, Esso-Varsol, Shell Mineral Spirits 135).
or
Bosch Part No. VS 14 942-CH
Former Part No. 5 973 340 650
The calibrating fluid can be obtained in 5 l metal cans from the following supplier:
Firma
Oskar Gnamm GmbH & Co
D-7531 Kämpfelbach-Bilfingen

Caution:
For safety reasons, never use normal gasoline or similar easily inflammable and combustible liquids. Even with calibrating fluid, be sure to observe the local official regulations.



17.2 Connecting the injection valve to the tester

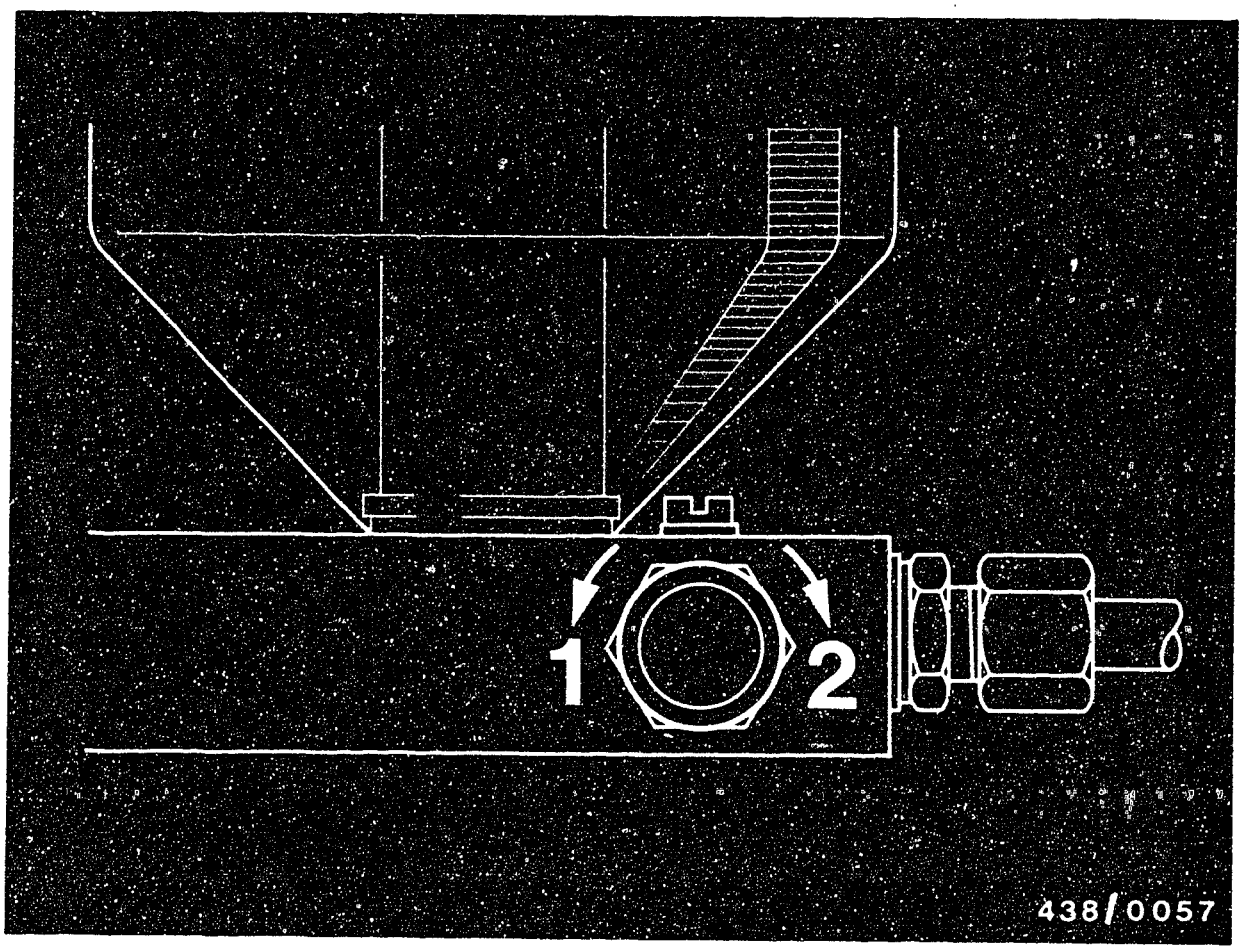
Connect injection valve to valve tester and bleed the discharge tubing by moving the lever back and forth several times with the union nut open. Then tighten the union nut.

17.3 Checking for dirt

Move the hand lever slowly (about 2 seconds per stroke) back and forth with the stopcock on the pressure gauge open. If the pressure does not build up to 1...1.5 bar gauge pressure, the injection valve has a bad leak (caused, for example, by dirt stuck in it).

You can try to flush the injection valve clear by moving the lever back and forth several times strongly.

If this attempt is successful, continue the test. If it is not possible to flush the valve clear, replace it.

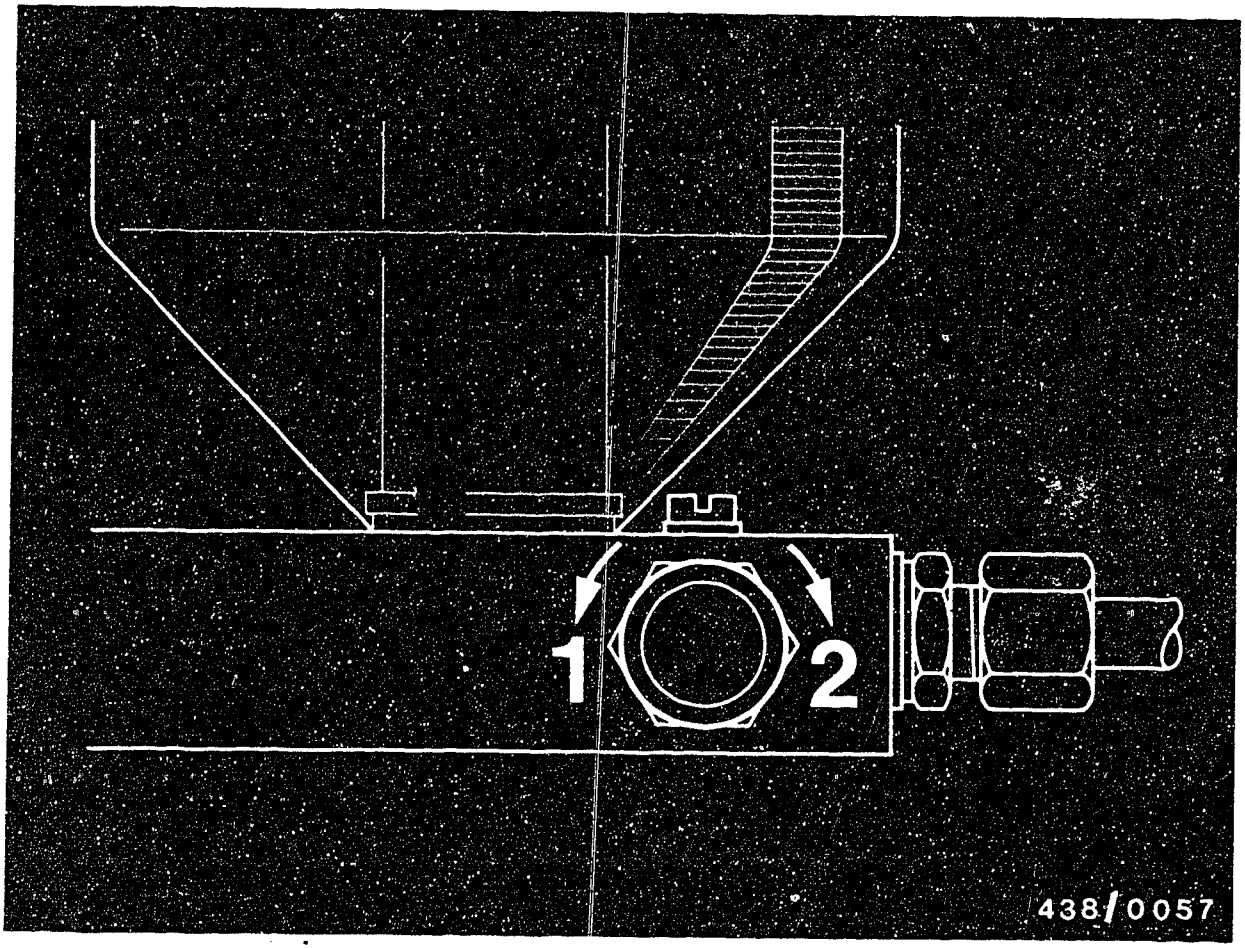


1 = Open
2 = Close

17.4 Testing the opening pressure

Injection valve Part No.	Test specifications - Opening pressure (gauge pressure)
0 437 502 020	3.0...4.1 bar (3.1...4.2 kgf/cm²)

With the stopcock closed, flush the valve out and bleed it with several rapid movements of the lever.
Open the stopcock and test the opening pressure by moving the lever slowly (about 2 seconds per stroke).
If the opening pressure is outside tolerance, replace the injection valve. Individual valves can also be interchanged within a set.



17.5 Leakage test

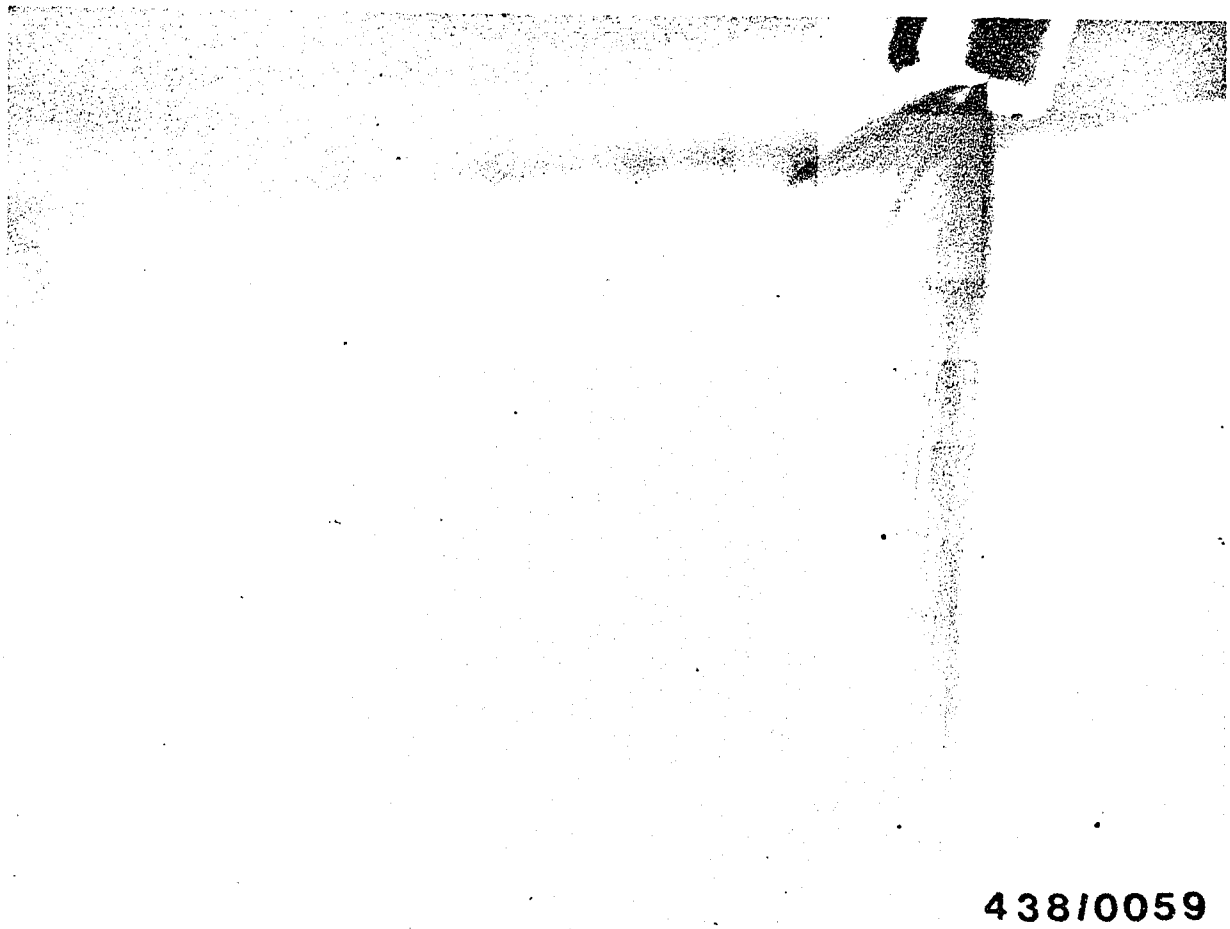
Open the stopcock, build the pressure up slowly to a value 0.5 bar under the opening pressure determined previously (but not less than 2.8 bar gauge pressure), and hold it constant at that level. No drops must now fall from the valve for the next 15 seconds.

43810058

17.6 Chatter test, evaluation of spray

Move the lever back and forth at about 1 stroke per second. As this is done, the valve must chatter. No drops of fuel must form at the mouth of the valve. The valve must not produce a "cord spray". Formation of a single-sided, atomized spray within an overall spray angle of about 35° is permissible (see example given in illustrations).

Illustration shows good spray formation.

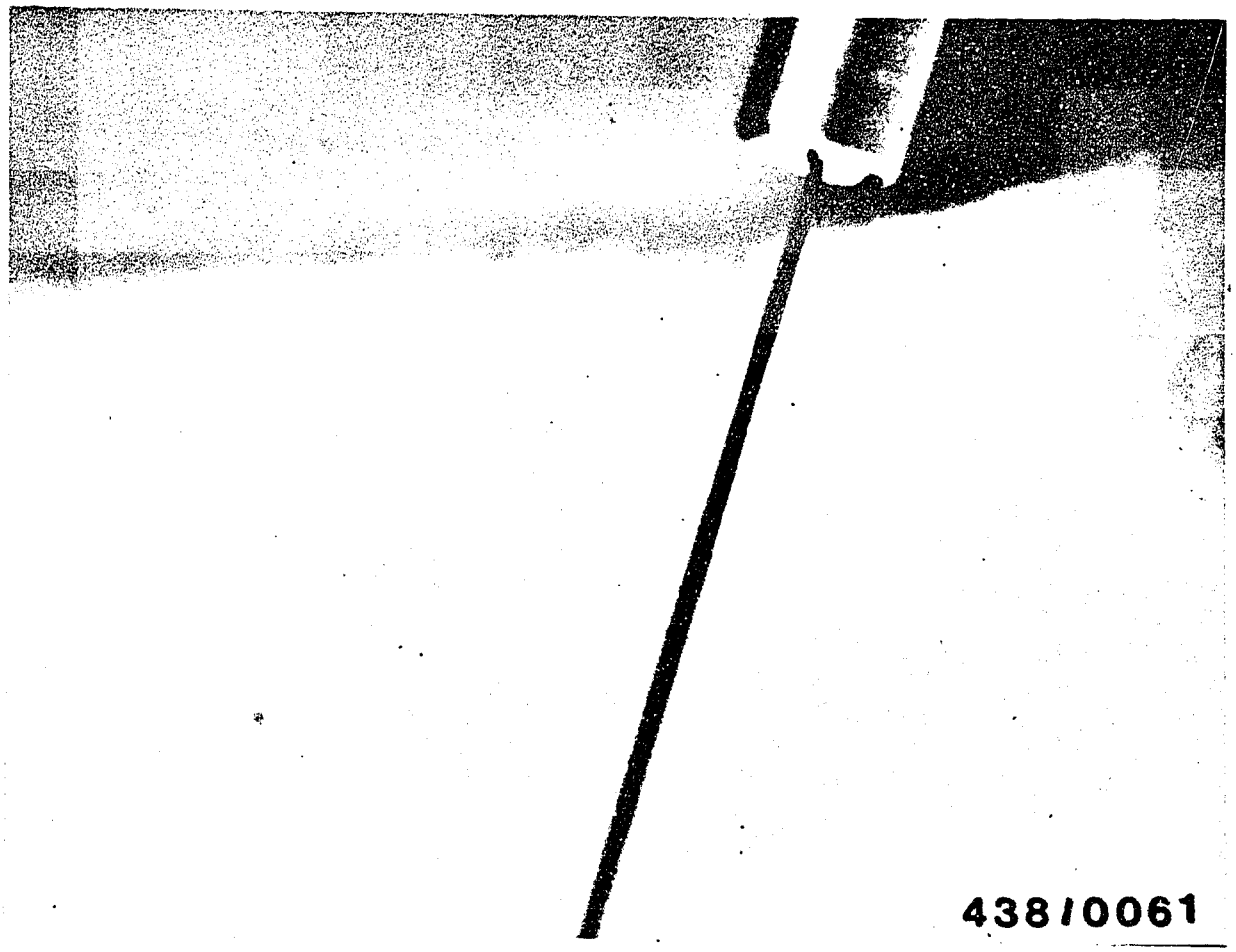


438/0059

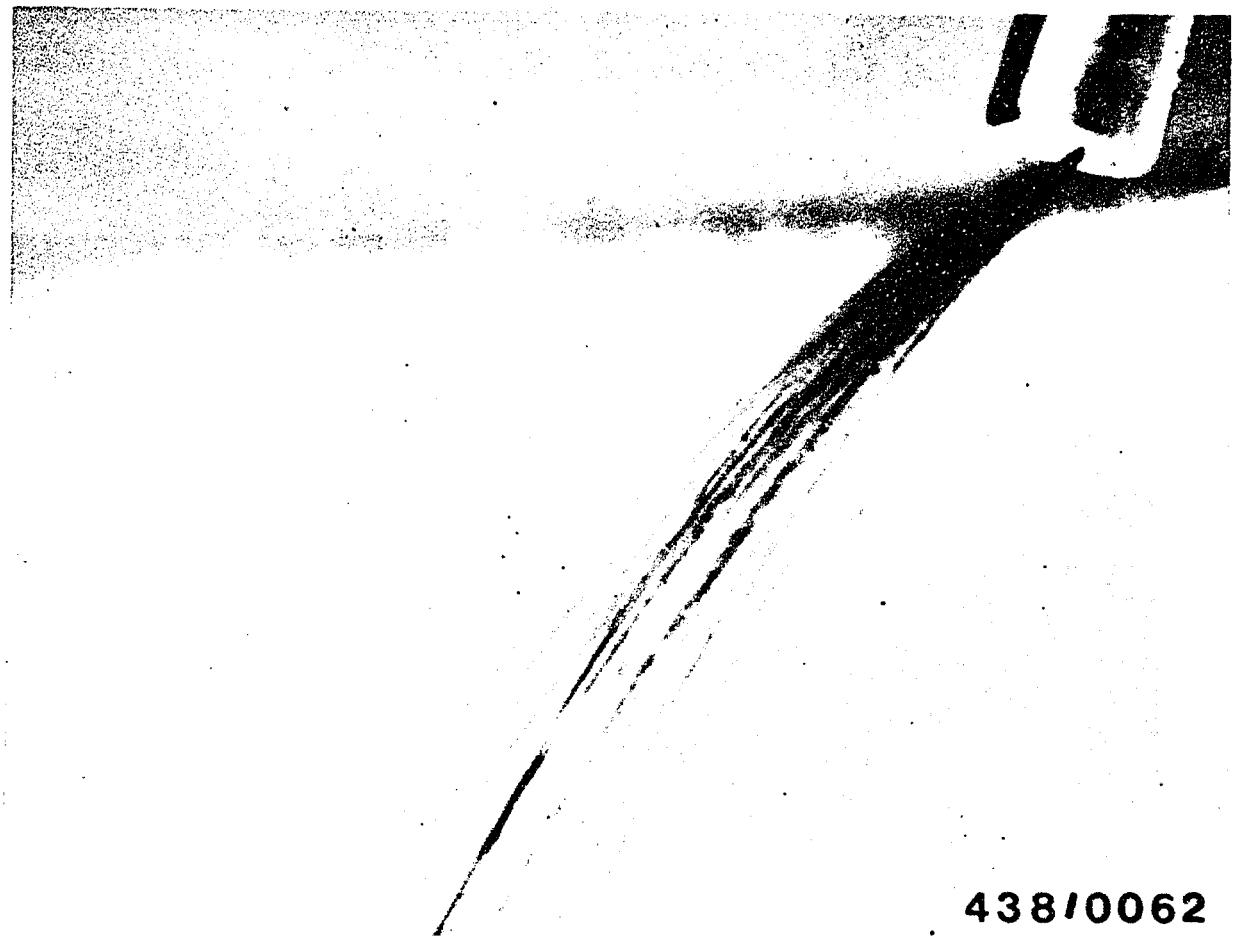
Illustration shows single-sided but nevertheless good spray formation.

438/0060

Poor spray formation; replace injection valves.
Illustration shows drop formation.



Poor spray formation; replace injection valves.
Illustration shows "cord" spray.



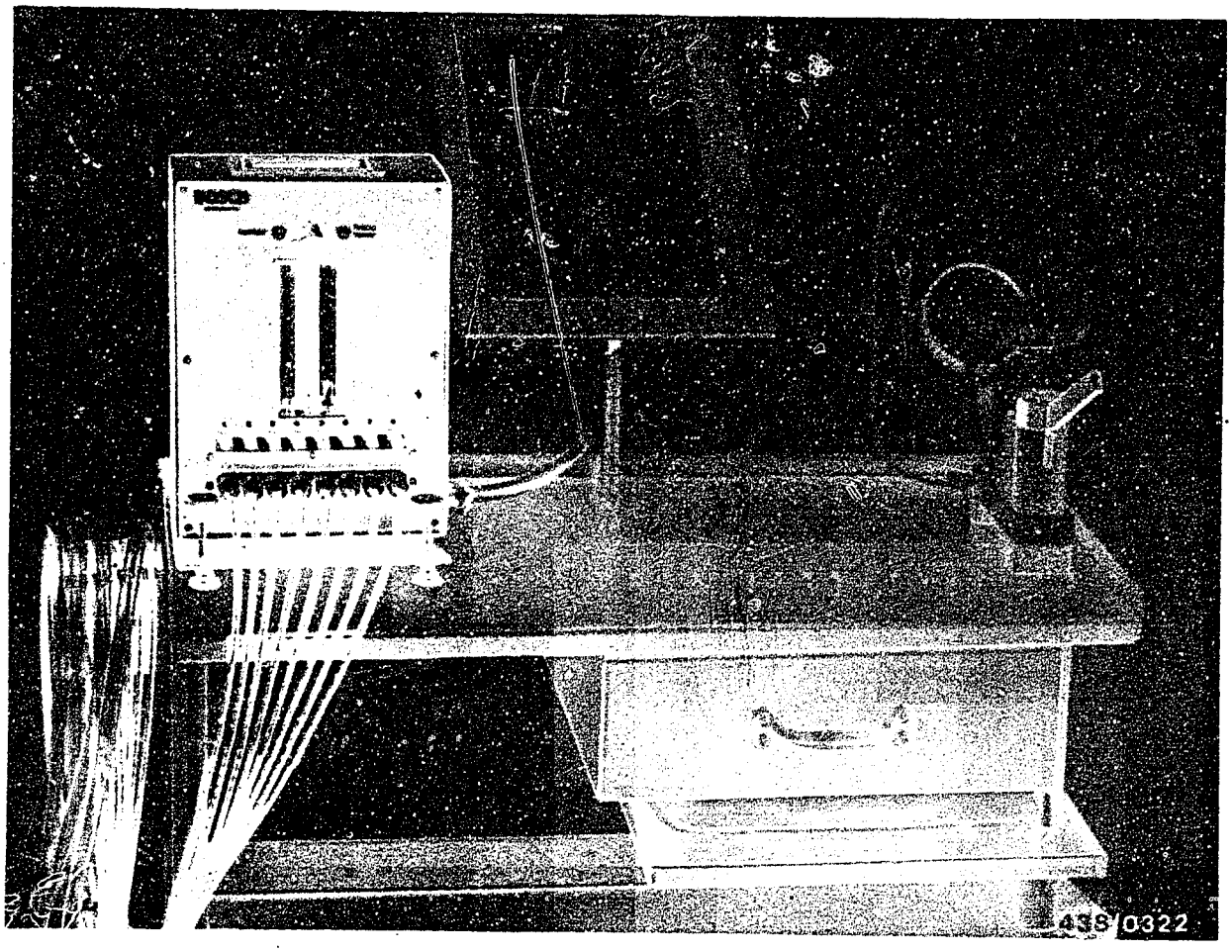
438/0062

Poor spray formation; replace injection valves.

Illustration shows "spray in strands".

If defective injection valves have been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.

Idle-speed adjustment is described on Coordinate F12.



18. Comparative measurement of fuel delivery of fuel distributor outlets.

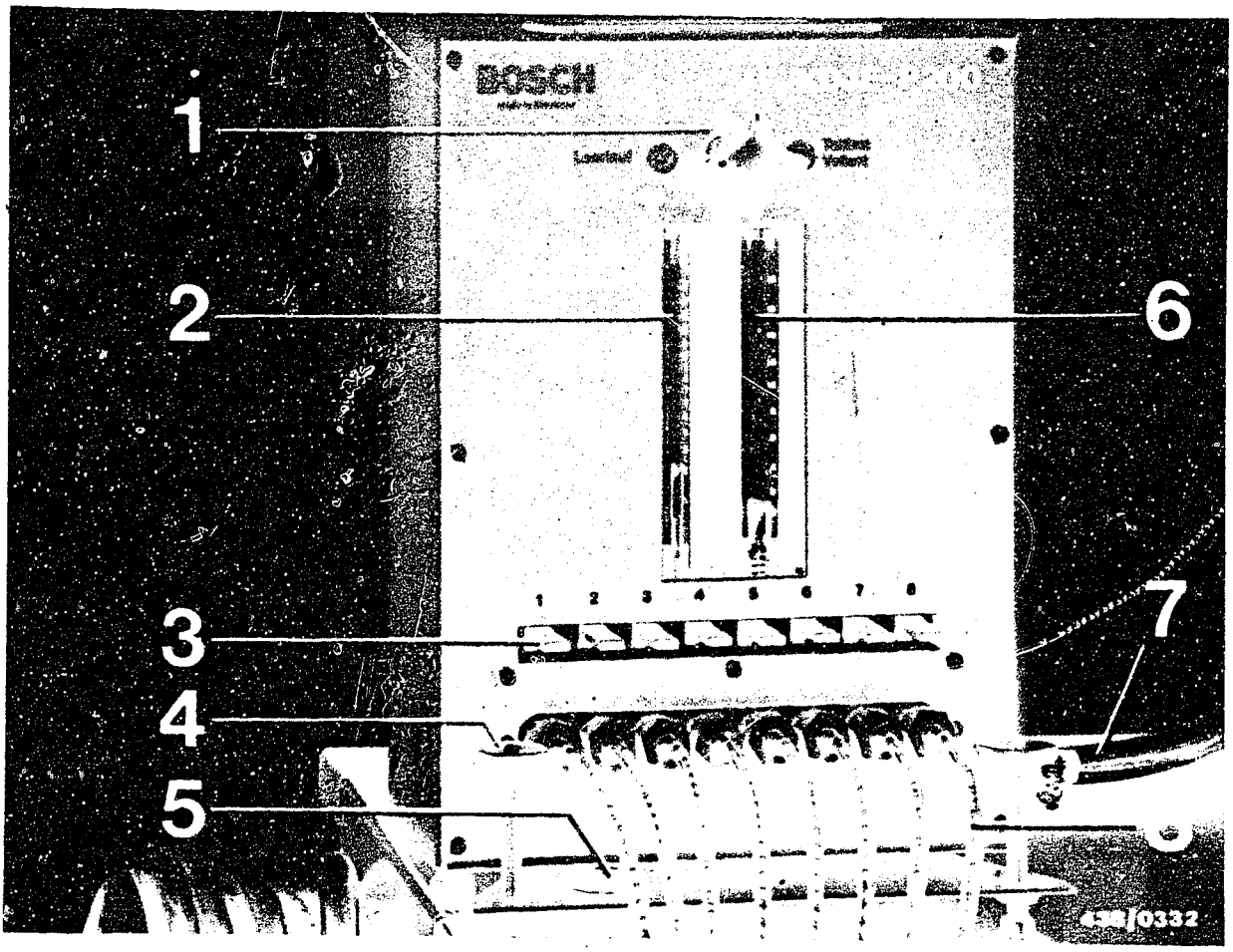
This test is carried out using the tester for delivered quantity comparison KDJE-P200 (previously KDJE 7451).

18.1 Application

By means of comparative measurements, the differences in the amounts of fuel delivered from the individual outlets on the fuel distributor are determined.

The tester is designed so that the test can be made on the vehicle without having to remove the fuel distributor.

Since the test is made with the original injection valves, the operator can recognize at the same time whether delivered-quantity scatter, if it occurs, is caused by the fuel distributor or by the injection valves.



1 = 3-way cock
2 = Small rotameter tube
3 = Keyboard for 8-way valve
4 = Adjusting screw for setting up
5 = Spirit level
6 = Large rotameter tube
7 = Return hose
8 = Hose lines

18.2 Construction

The tester is designed for use with all engines, up to 8 cylinders, equipped with K-Jetronic.

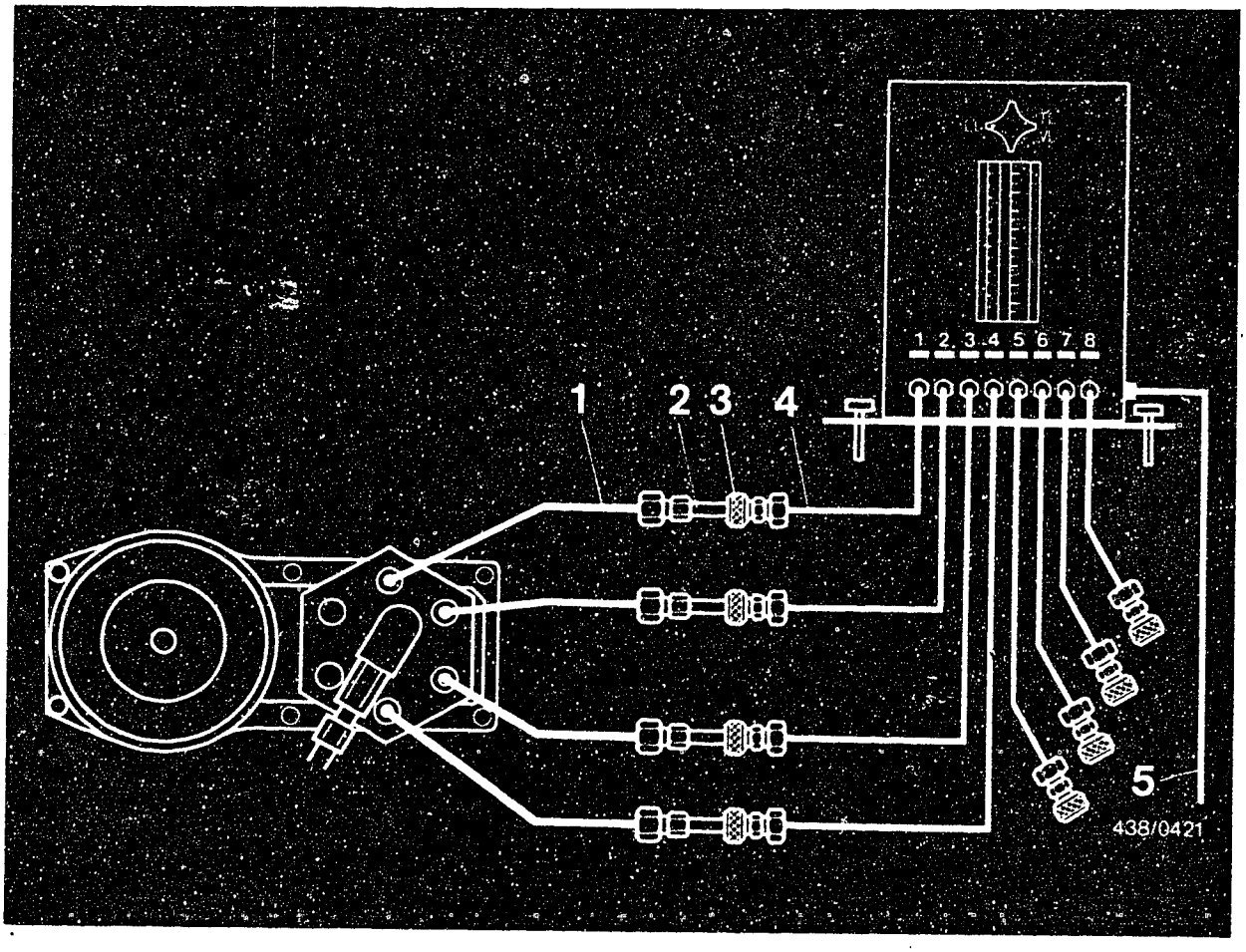
Basically, the tester consists of a steel housing containing 2 rotameter tubes with measuring ranges of 2...15 cm^3 and 10...180 cm^3, an 8-way valve for key operation (Item 3) and a 3-way stopcock (Item 1).

The small rotameter tube (Item 2) is used for the idle measurement while the large tube (Item 6) is used to measure the fuel delivery at part- and full-load. The particular rotameter tube to be used is connected by means of the 3-way stopcock. Using the 8-way valve, the fuel delivery of each cylinder is tested one after the other.

Attached to the tester are 8 hoses (Item 8), each terminated with an automatic connector. When the injection valves are withdrawn from their sockets on the engine they are attached to these connectors. Each automatic connector is fitted with a push valve so that no fuel can escape from connectors that are not in use (when 4- or 6-cylinder systems are tested).

The fuel is returned to the fuel tank through a hose (Item 7) about 5 m long.

The entire test is made with a closed circuit, i.e. no fuel escapes.



1 = Adapter connection hoses from line set KDJE-P200/25
2 = Injection valves
3 = Automatic connectors
4 = Tester hoses
5 = Return line to fuel tank filler neck

18.3 Setting up and connecting the tester:

Set the tester up beside the engine on a solid base (e.g. on tester trolley KDJE-W 100) and align it with the built-in spirit level at the base of the tester.

So that the rigid fuel-injection tubing is not bent too much, the tester for delivered quantity comparison is connected using the adapter connection hoses KDJE-P200/25.

Remove the injection valves completely.

Unscrew the fuel-injection tubing from the fuel distributor and connect the adapter connection hoses instead.

Screw the injection valves onto the adapter connection hoses.

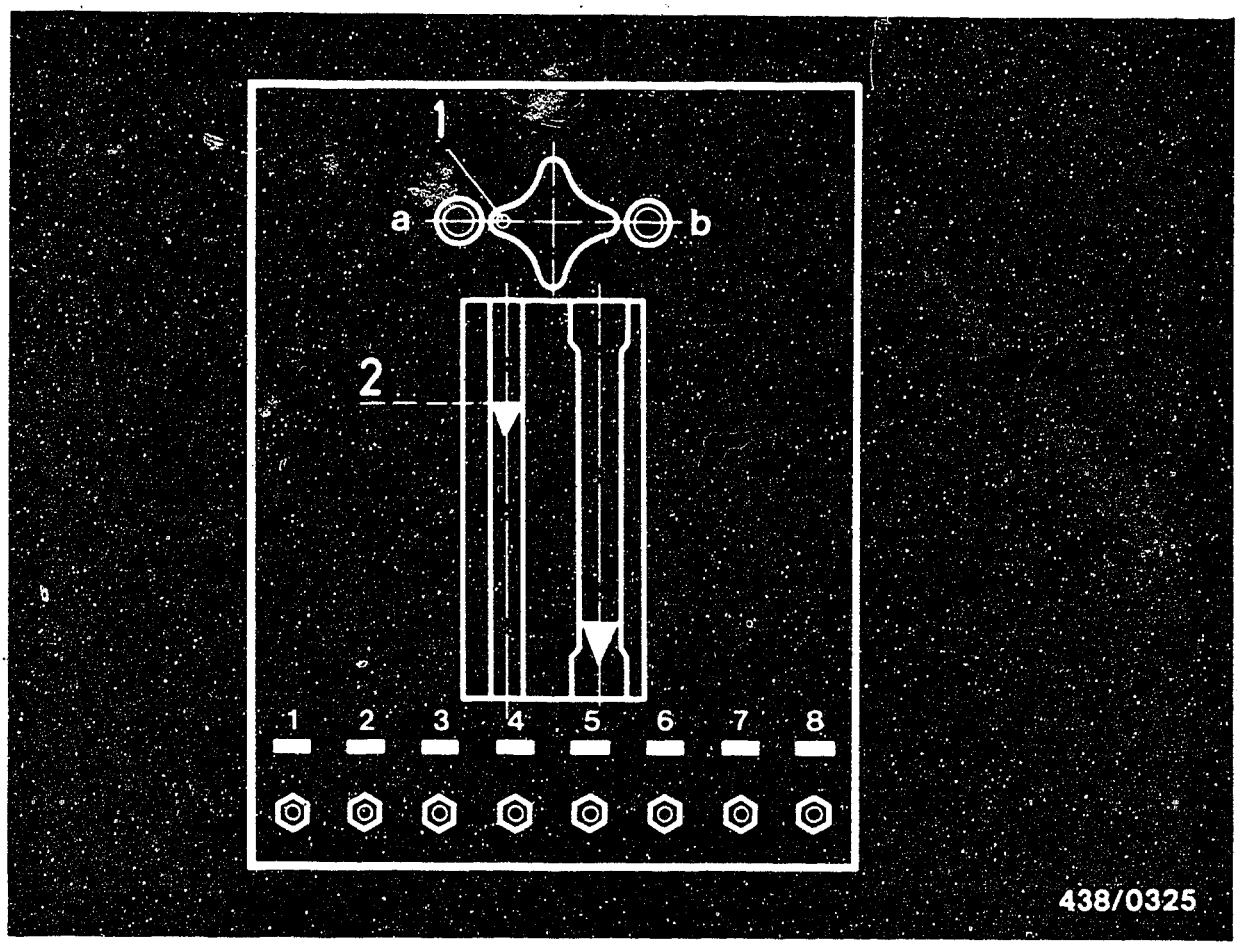
Clean the injection valves with a rag and insert injection valves into the automatic connectors of the first four tester hoses.

Note:
Insert the injection valves as far as they will go and tighten the knurled thumbscrews well so that the non-return valves of the automatic connectors are opened fully.

Introduce the return hose of the tester into the fuel tank filler neck.

18.4 Bleeding the tester:

Remove the air filter so that the air-flow sensor plate becomes accessible.
Remove the electric plugs from the warm-up regulator and the auxiliary-air device.
Switch on the electric fuel pump by bridging the electrical safety circuit.
Press down the air-flow sensor plate to the stop.
Press the keys on the 8-way valve one after the other, while simultaneously switching the 3-way stopcock until both rotameter tubes are bled.
Return the sensor plate to the rest position.



a = Idle
b = Part load/full load

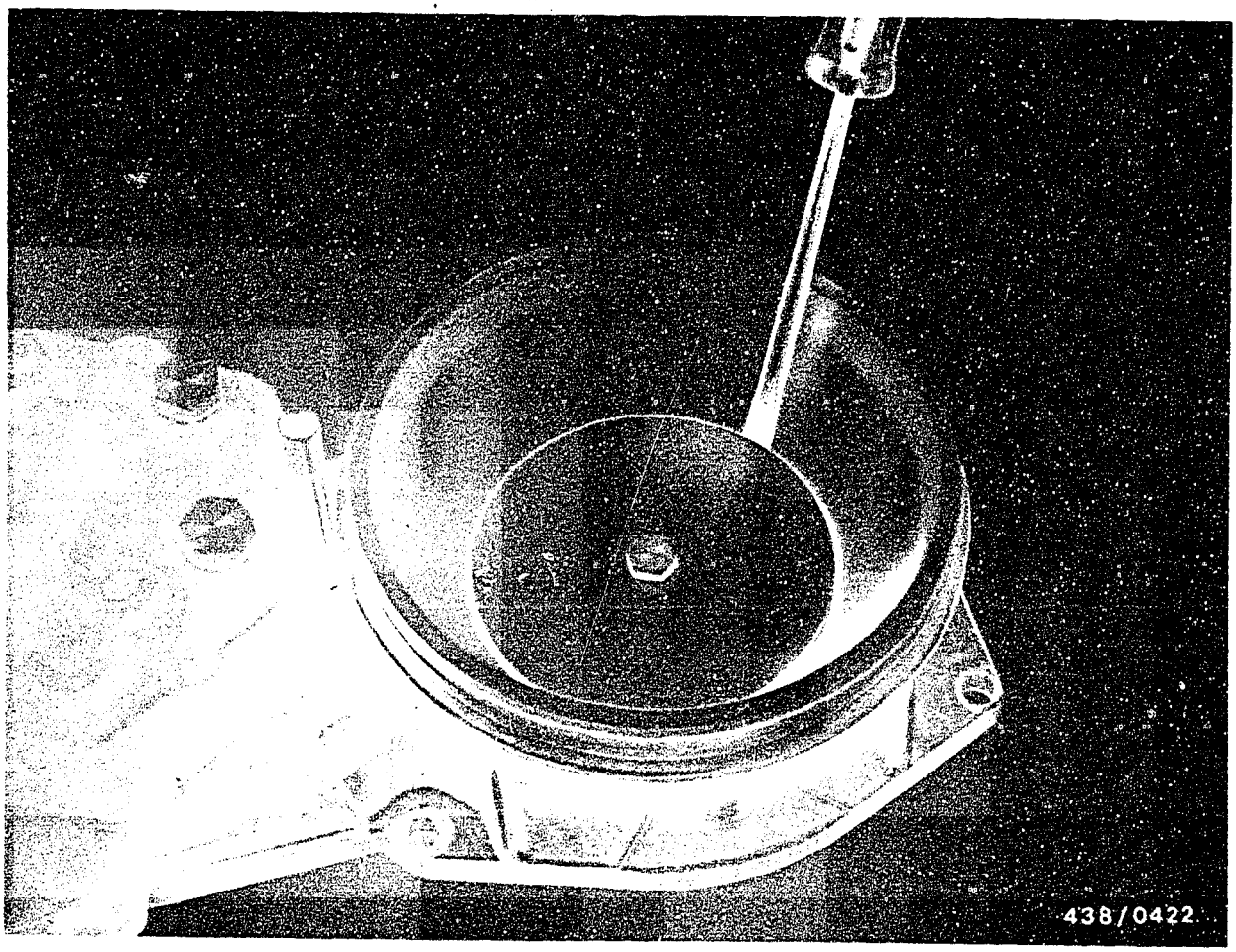
1 = White dot
2 = Measuring line

18.5 Testing:

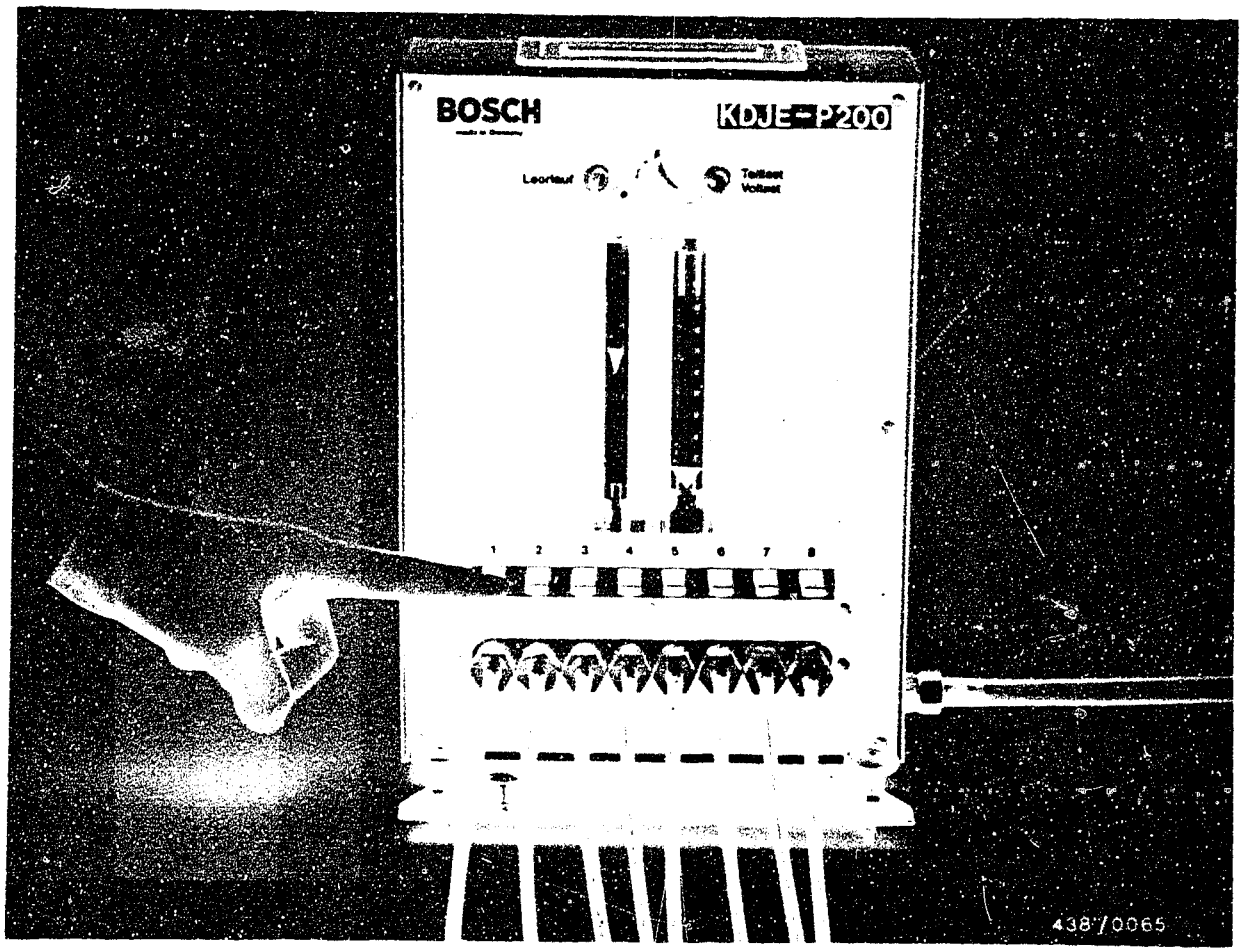
The flow comparison measurement is made in the idle, part-load and full-load ranges.

The small rotameter tube is to be used for the idle measurement (white dot to left on control knob); part-load and full-load measurements are made using the large rotameter tube (white dot to right).

The delivered quantities indicated on the rotameter tubes are read off at the top edge of the conical float (Item 2).
On testers with a ball float the uppermost point of the ball is used for reading off. With each measurement be sure to wait until the float has reached its final position. This may take 20...30 seconds in the case of small deliveries.



The exact setting and locating of the position of the air-flow sensor plate for the various load ranges is done using a screwdriver (in the case of the idle position, a small one), which is inserted to a suitable depth between the air funnel and the air-flow sensor.



Procedure:

Switch on the electric fuel pump by bridging the electrical safety circuit.
Fixed numerical values are specified in the following test section for the maximum permissible fuel delivery differences for the individual load ranges.

The "set point" value always pertains to the fuel-distributor outlet with the lowest fuel delivery, i.e. in each case the outlet with the lowest delivery is to be first ascertained.

Press the key for outlet 1. Pivot the air-flow sensor plate until the corresponding rotameter tube approximately indicates the "set point" value. Fix the air-flow sensor plate in this position.

Test the remaining outlets in order to determine which outlet has the lowest fuel delivery.

Press the key for this outlet again, and set the delivery precisely to the "set point" by correcting the position of the air-flow sensor plate. Then fix the air-flow sensor plate in this position again.

Press the remaining keys one after the other, and determine the maximum fuel delivery of each outlet. A deviation in fuel delivery can only be above the "set point".

18.6 Test specifications

	Setpoint (cm^3/min)	Max. permissible fuel delivery (cm^3/min)
Idle	6.0	6.8
Part load	40.0	44.0
Full load	160.0	175.0

If too large a deviation is determined during checking in one of the three load ranges, then the test should be repeated to make sure.

If the result is confirmed, check whether the cause lies in the fuel distributor or in the injection valves.

For this purpose, exchange the injection valve with the greatest deviation with that with the smallest.

If the result remains the same, the cause lies in the fuel distributor.
If not, it lies in the injection valves.

Replace the defective fuel distributor or injection valves.

18.7 Final operations

Re-fit the injection valves properly. Also fit the air filter. Make sure that all lines are laid correctly.

Re-connect the electrical safety circuit of the K-Jetronic properly.

Check that all line connections are not leaking by carrying out a test run.

Finally, check the idle-speed adjustment and, if necessary, correct it (Cordinates F 12).

19. Idle-speed adjustment

19.1 Test conditions:

Warm up the engine for adjusting the idle speed (oil temperature approx. 80°C).

Important note:

Never rev the engine immediately after starting, but let it idle for a while first so that the oil pressure in the turbo-supercharger is built up thus ensuring the lubrication of the supercharger.

Moreover, the engine must not be switched off immediately when operating in high-speed range, but must be allowed to idle a little first before being switched off. If this point is not observed, the turbo-supercharger runs on for a long time without lubrication and can thus be damaged. Besides this, a short period of idling before switching off the engine leads to better heat dissipation from the turbo-supercharger.

If the fuel-injecting tubing or injection valves were loosened or removed, the engine should be warmed up under load. The low rate of fuel flow during idling is not always adequate to drive all the air out of the fuel-injection tubing.

The idle speed must not be adjusted when the engine is too hot, e.g. immediately after being raced or after a power measurement on the roller-type test stand.

In vehicles with an air conditioner, this should be switched off in order to stabilize the engine speed.

Important note for vehicle models for Sweden and Australia:

Vehicle models for Sweden and Australia are equipped with a "pulse-air"system.

In this system, unburnt gases in the exhaust gas are subject to afterburning by flushing with air, and thus a reduction in the amount of pollutants in the exhaust gas is achieved.

This system does not operate with secondary air pumps but uses the pulsation in the change between gauge pressure and vacuum in the exhaust system.
When there is vacuum, additional air is sucked into the exhaust manifold.
When there is gauge pressure, non-return valves stop exhaust gas returning to the air filter.

The "pulse-air" system should be switched off during idle testing and adjustment:
Disconnect hose between pulse-air valve and air filter at the air filter and seal it tightly with a plug.

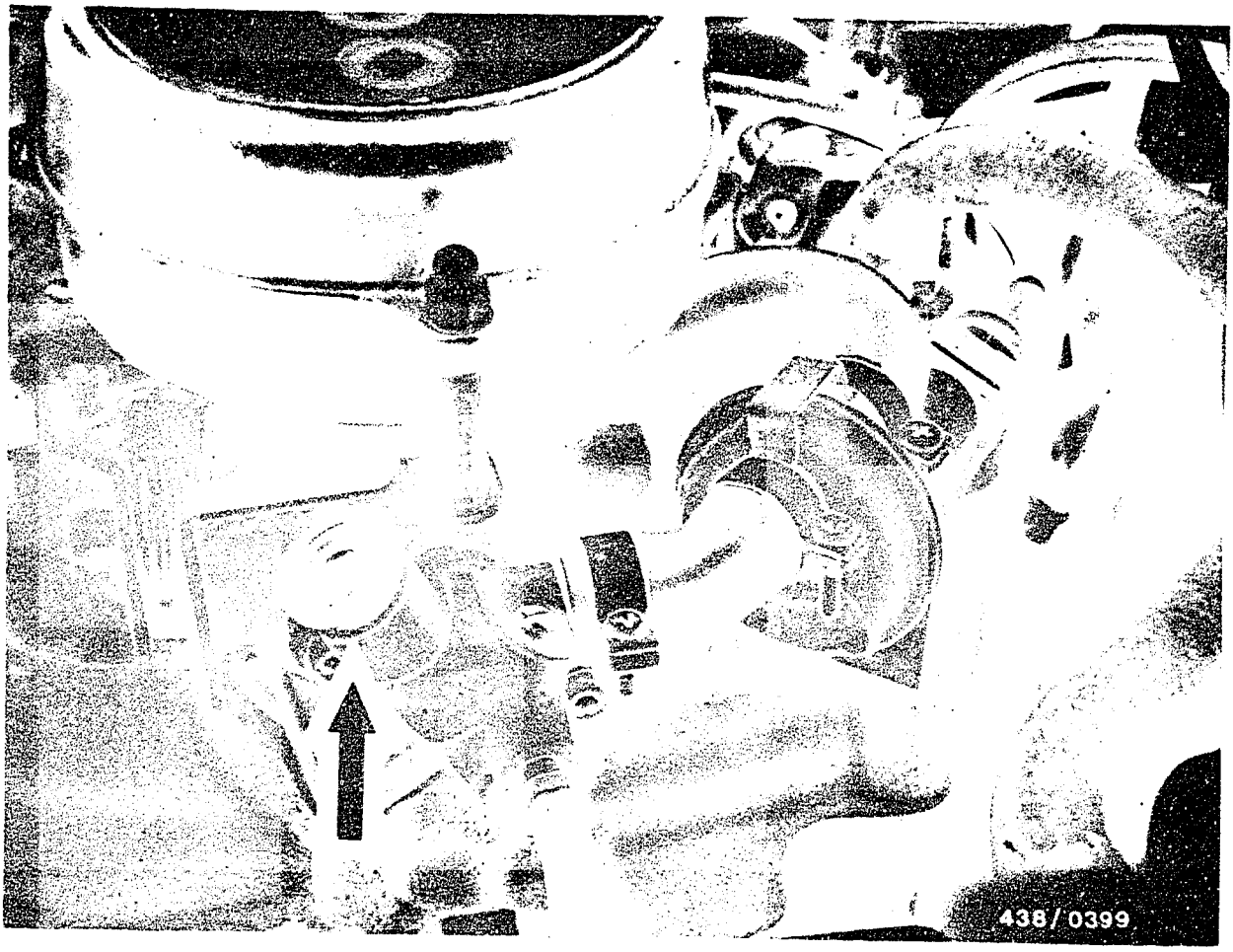
19.2 Test specifications - adjustment of idle speed and CO content:

Idle speed
All models: 900 min^{-1}

CO content (Vol. %):*
Test value
All models: 1.0...3.0%

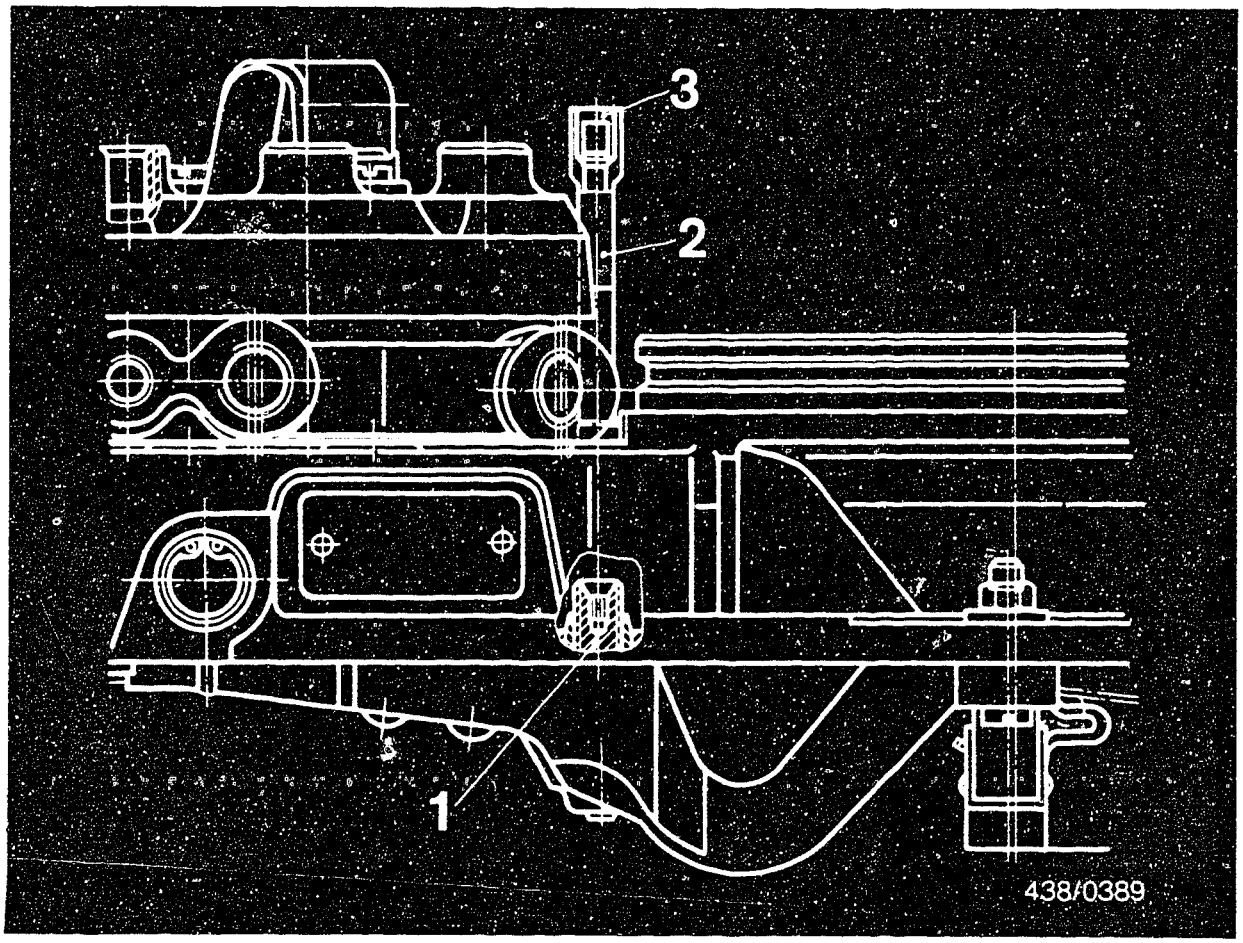
Setting value
All models: 2.0%

* Engines whose CO value lies within the checking tolerance and which have an otherwise perfect true running do not have to be adjusted.
If the CO value is outside the checking tolerance, adjust to setting value.



19.3 Adjustment:

Adjustment of the idle speed at the bypass: screw in the throttle-valve assembly (arrowed).



Adjust the CO content by turning the idle-mixture-adjusting screw (1) in the mixture-control unit using an adjusting wrench KDEP 1035.
After removing the anti-tamper cap (3) in the guide tube (2), the adjusting wrench is passed through the guide tube and inserted into the idle-mixture-adjusting screw (1).
Clockwise rotation: richer mixture
Anti-clockwise rotation: leaner mixture
Caution: Always make the adjustment from the lean side, i.e. if the mixture is too rich turn the idle-mixture-adjusting screw further to the left than necessary, and then turn it to the right up to the setting required.
Remove the adjusting wrench after every adjustment and accelerate the engine briefly so that the induction intake passages cool down. Then wait until the indicator on the CO tester has stabilized. Do not accelerate the engine with the wrench still in place because this could result in bending the control lever in the air-flow sensor.

Clockwise rotation: richer mixture
Anti-clockwise rotation: leaner mixture

Caution:
Always make the adjustment from the lean side, i.e. if the mixture is too rich, turn the idle-mixture-adjusting screw further to the left than necessary, and then turn it to the right up to the setting required.

Remove the adjusting wrench immediately after every adjustment and accelerate the engine briefly. Never accelerate the engine with the wrench still in place because this could result in bending the control level in the air-flow sensor.

Anti-tamper device for idle-mixture-adjusting screw:
In the Federal Republic of Germany, § 47 of the FMVSS/CUR, "Exhaust Gases and their Discharge", has been amended. This amendment order was printed in full in the Verkehrsblatt 13 of 15th July 1975.

Accordingly, all motor vehicles with externally supplied ignition produced as of 1st October 1976 must be provided with anti-tamper devices for the idle-mixture-adjusting screw so that it is not possible to adjust the screw without destroying the anti-tamper device. The intention is to prevent non-experts from readjusting the idle setting and thus inadmissibly influencing the exhaust gas. Consequently, the anti-tamper caps may only be used in the workshop and must not be sold to customers for their own use.

These anti-tamper caps come in different colours. The anti-tamper cap to be used in after-sales service is red and has the following part number: 3 430 522 002.

The bore of the setting device (for receiving the adjusting wrench) is sealed by a plug.
The anti-tamper device is removed and fitted using special tools (e.g. tool set No. 4521/7 from Hazet Co., 5630 Remscheid).

After-sales Service

Technical Bulletin

Packaging of goods under warranty

438

K-Jetronic (CIS)

VDT-I-438/101 B
10.1976

All components or assemblies of the K-Jetronic which are dispatched under warranty must be correctly and carefully packaged so that no further damage or impairments occur during transit, since these would not be covered by warranty.

Any fuel remnants must be removed from those K-Jetronic assemblies intended for dispatch, so as to eliminate any danger of fire during transit.

The intake openings and outlets of the assemblies must be sealed off with caps or plugs. As new products were fitted, the caps or plugs from these may be used.

The plunger of the fuel distributor is to be fitted with a protective cap of adequate size, or secured to the fuel distributor.

In addition, the assemblies are packed in tightly packed, well-sealed plastic sleeves. Fuel distributors and warm-up regulators are packed individually.

If components arrive damaged due to incorrect packaging or do not comply with these instructions, they can be returned and the warranty claim rejected.

BOSCH Geschäftsbereich KH Kundendienst: Kfz-Ausrüstung

After-sales Service

Technical Bulletin

Securing of idle-speed adjusting screws

K-Jetronic (CIS)

438

VDT-I-438/102 B
11.1976

According to a statutory regulation, changes have been made to § 47 of the German traffic licensing laws concerning exhaust gases and their outlets. This regulation was printed in full in traffic law sheet 13 of 15.7.75 .

Consequently, all motor vehicles with external-ignition engines must have their idle-speed adjusting devices secured from the 1st October 1976, so that adjustment of the screw is impossible without destroying the securing device. This should stop unskilled people from adjusting the installation of the idle-speed system and thereby illegally influencing the emission values. As from now, securing caps can only be used in the workshop and cannot be sold to customers for their own use.

Securing caps are produced in various colors. For after-sales service the following caps and colors are used:

downdraft air-flow sensor

Blue	securing cap is not available from BOSCH. Part number is DB 000.997.59 86 from the Deutsche Vergaser Gesellschaft K 34 520

updraft air-flow sensor

Red	Part number 3 430 522 002

These stipulations are only valid in countries where ECE regulations (Economic Commission for Europe) apply. The air-flow sensors must however be converted for the use of these securing caps, as a matter of principle. The caps can also be used in countries not subject to ECE regulations, to prevent dirt penetrating through the pipe to the adjustment in the case of updraft air-flow sensors.

BOSCH

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After-sales Service

Technical Bulletin

HOT-STARTING PROBLEMS

438

VDT-I-438/105 En
3.1980
Replaces Ed. 2.1980

K-Jetronic

Hot-starting problems can occur in various vehicles fitted with K-Jetronic. This means that when an engine is switched off whilst still hot and then switched on again after a short period, it does not start as well as it should.

The engine, the ignition system and the K-Jetronic system in these vehicles should be carefully checked. With the K-Jetronic particular attention should be paid to the:

complete system (in case of leaks),
injection valves (in case of leaks),
correct position of the air-flow sensor plate (rest position).

Instructions can be found in the vehicle-related repair manuals VDT-W-438/5.. .

If the engine still does not start satisfactorily when hot, even after checking, a timing relay can be fitted in K-Jetronic systems which are not equipped with a solenoid valve for reducing the control pressure as additional starting help.

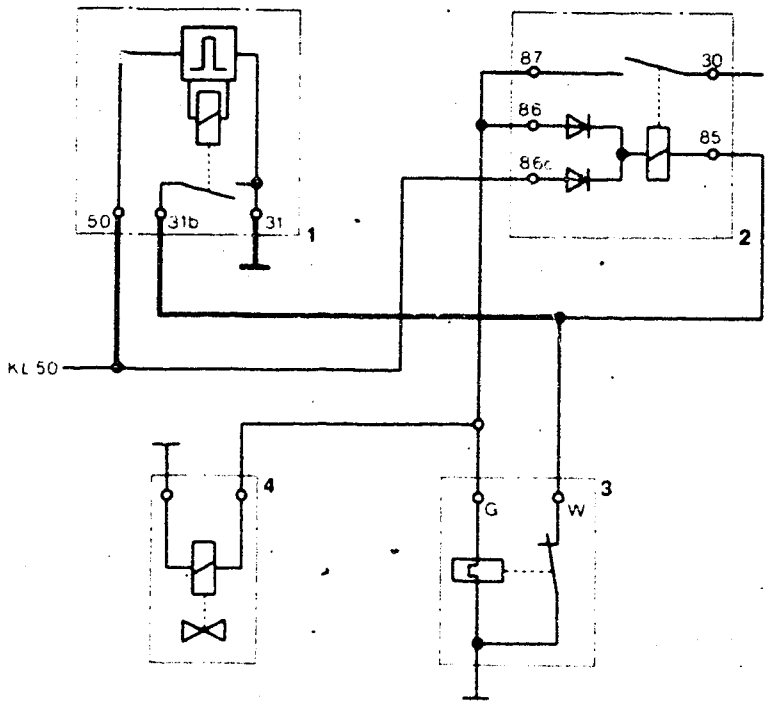
Timing relay 0 340 000 003 controls the start valve during hot starts. The start valve then injects extra fuel intermittently (sometimes cutting out completely.

The timing valve is fitted according to the wiring diagram (see reverse side). The fitting of this relay will be charged for.

After fitting the timing relay starting should be carried out as follows:

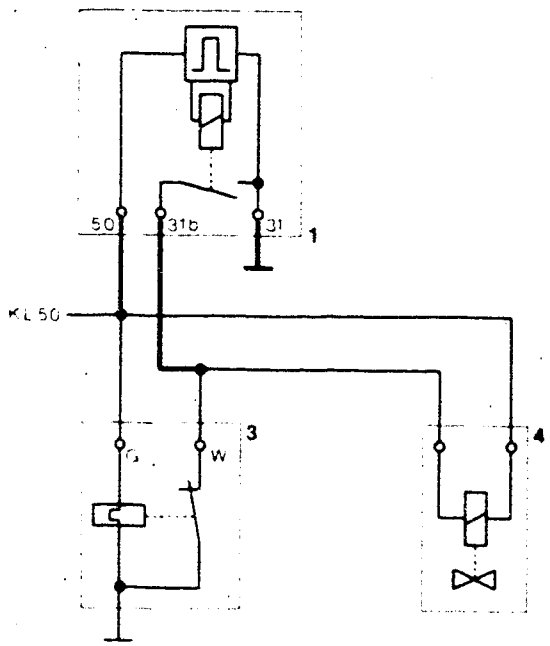
Vehicles with start valve in intake manifold - with open throttle valve,
Vehicles with start valve in idle duct - with closed throttle valve.

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung



K-Jetronic system with post-injection relay

1 = Timing relay 0 340 000 003
2 = Post-injection relay
3 = Thermo-time switch
4 = Start valve



K-Jetronic system without post-injection relay

After-sales Service

Technical Bulletin

FIRMLY FITTED NON-RETURN VALVE

Repairs
fuel pumps 0 580 254 ...

VDT-I-438/107 En
5.1980

Previously fuel pumps with non-exchangeable non-return valve (see VDT-I-438/104 En) had to be exchanged completely in cases of leakage in the non-return valve.

If the fuel pump is in working order and only the non-return valve leaks, there is now the possibility of repairs as part of after-sales service. 2 parts sets have been produced for this purpose, they contain, amongst other things, a tube fitting with built-in non-return valve.

Before using the parts set the installation conditions should be checked. The defective non-return valve can remain in the fuel pump which does not have to be dismantled for fitting the parts set. Before disconnecting the fuel lines the pressure fittings of the fuel pump and the fuel lines should be thoroughly cleaned.

Description and fitting

Parts set 1 587 010 003 for fuel connection with inlet union.

Screw the tube fitting (short side) with the thick flat seal ring into the pressure fitting and tighten. In doing so press against the hexagon of the pressure fitting with a wrench. Place the thin flat seal ring, the fuel-line inlet union and the other flat seal ring on to the long side of the tube fitting and tighten with the hexagon cap nut. Run the engine and check that there are no leaks in the connection.

Parts set 1 587 010 004 for fuel connection with nipple and union nut.

Screw the tube fitting with flat seal ring into the pressure fitting and tighten. In doing so press against the hexagon of the pressure fitting with a wrench. Screw the fuel line to the tube fitting with a union nut and tighten. Run the engine and check that there are no leaks in the connection.

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